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Prospect for 1951

ADAPTATION TO ABNORMAL CONDITIONS

UPON the whole, in spite of many difficulties, the electrical industry can be satisfied with its work during the past year. Increased turnover, with profits commensurably higher, has been reported by most units although some sections, notably in the domestic appliance field, have not done so well as they would have done in normal circumstances.

It seems, however, that a new standard of normality will have to be adopted. Some major problems confront the electrical, in common with other, industries. Among them are the growing scarcity and high cost of staple materials, not the least of which is coal, and the inadequacy of generating capacity. The course of events during 1950 in the commodity markets principally affecting the electrical industry is reviewed in this issue and some indication of immediate prospects is given.

Incidence of "Cuts"

The nation is now committed to a programme of rearmament which must continue for years so far as can be foreseen at the moment. Material production is unlikely to expand sufficiently to cope with this as well as with all the other needs and so "cuts" will inevitably have to be made somewhere.

Our dependence on supplies from overseas, which have to be paid for, forbids any serious reduction in exports. By rigorous restriction in the home market export trade has been built up to a record volume of which electrical machinery and equipment have become an ever-increasing proportion. It can be said that electrical "productivity," although susceptible to improvement, has not been unsatisfactory, for the industry has also met increasing home demands in so far as it was physically capable of doing so.

Economy in Materials

When materials are not available in sufficient quantities greater efficiency in production may lead to better and speedier results but it cannot appreciably affect the volume of output. What is needed is a more economic use of materials and it is to this end that manufacturers' studies must be principally directed. It may be possible to employ substitute materials in many cases but for the most part available supplies will have to be spread more thinly. The problem will then be how far to go while still ensuring efficiency, safety and durability.

If, as seems clear, the home market is to bear the main impact of shortages caused by the rearmament demand the

Government must be on its guard against suggestions that the generating and distribution programme should be trimmed. Without an adequate supply of electricity modern industry cannot carry on. Caution must also be observed in the matter of suggested restrictions and discrimination in supplies to non-industrial consumers. There is a tendency to forget it is the peak demand that has to be attended to—not the consumption of electricity. The B.E.A. and Electricity Boards are fully at liberty to sell electricity but they must continue to try to get consumers to use it at the right times.

In this country we are inured to inconvenience and can bear hardships when they are believed to be unavoidable. It will help us to make the best of an unpleasant situation if we can be sure that Government policy and procedure are wisely directed and that controls and restrictions are imposed only when they are essential.

"PROMOTION" SUSPENDED

Superficially there is some justification for the decision of the British Electricity Authority (under pressure from Government Departments) to suspend "promotional" advertising for a time. There has been a great deal of misguided criticism of the B.E.A.'s advertisements which, while warning people to "Keep Off the Peak" have also suggested that electricity can be freely used in off-peak hours. In our opinion these attempts to improve load factor have been economically sound but now, it seems, the use of electricity has become a social sin. If fuel economy is aimed at in these attempts to curtail off-peak consumption we question whether sufficient thought has been given to the matter. But as we have seen no widespread appeals to gas consumers we may presume that there are other reasons for regarding the extended use of electricity as undesirable.

COAL STOCKS

The unsatisfactory rate of output from the collieries is reflected in the state of power station stocks. About a month ago the amount of coal available at all the stations of the B.E.A. was equivalent to about four weeks' supply—well below the accepted working level but still not "dangerous." At the same time in 1949 there was about five weeks' coal in hand. The position is patchy, some stations being comparatively well off while others are well below the general average. Last week it was stated that stocks in the North Western Division of the B.E.A. were sufficient for only just over two and a half weeks' operation.

COPPER BAN

Makers of domestic electrical appliances will be seriously embarrassed by the prohibition of the use of copper for the production of these appliances. The handicap follows the adverse effects of power cuts. How quickly the position has changed may be gauged from the statement in the annual review of raw materials published elsewhere in this issue that in the early part of last year there were doubts whether this country could absorb the virgin copper envisaged in the Economic Survey. The proposed ban on the use of copper for certain purposes is partly to prevent its substitution for zinc of which there is an acute shortage. For many of the appliances mentioned in the provisional prohibited list, such as kettles, coffee percolators, etc., aluminium may be used, but manufacturers will want to know whether that, too, is likely to be controlled.

NEW YEAR HONOURS

We extend our congratulations to those electrical men whose names appear in the Honours List published this week. But once again we consider that their number is not commensurate with the importance of the electrical profession and industry in the national life. Two of the new knights, Messrs. E. D. A. Herbert and A. Mc. MacTaggart, have electrical connections, although electrical engineering is not their principal occupation. Among the new C.B.E.'s there appear the names of Mr. R. Baumann, whose work on steam turbines receives tardy recognition, and Mr. J. N. Waite, who is in charge of the London Division of the B.E.A. Another B.E.A. man, Mr. F. Shakeshaft, generation design engineer, becomes an O.B.E., an honour which is also conferred on Mr. R. G. Kilburne, chief electrical engineer to the Government of Nepal. One well-known name among the M.B.E.'s is that of Mr. Robert Lee, Sub-Area liaison officer, London Electricity Board, and with him are Mr. W. J. Cooper (S.W. Scotland Electricity Board) and Mr. L. Rushforth (B.T.H. Co.).

Resistance Strain Gauges

Application of A.C. Bridge Methods

By T. B. SANSOM,

A.M.I.Mech.E., A.Amer.I.E.E.

WHEN stress change can no longer be followed by a galvanometer, its measurement becomes one of an alternating nature and the technique has to be modified. The first factor to receive attention is temperature change. With dynamic measurements, where rapid variations of strain have to be recorded, any temperature changes are so slow by comparison that the corresponding change of resistance is negligible during the period of variation. It is therefore not necessary to use a compensating gauge.

The ordinary resistance-capacity amplifier, while not applicable to all alternating stress problems, does to a large extent meet most requirements. To give some idea of its limitations it is essential to consider the factors that influence amplifier performance in relation to strain gauge work.

The problem may be considered in a number of ways, remembering that the performance of an amplifier is usually expressed in terms of an input to output relationship for a sinusoidal input, as a function of the frequency input. On this basis the amplifier may distort the input from the strain gauge in four ways.

The amplification may not be independent of the amplitude of the input signal (for a fixed frequency). This is amplitude or non-linear distortion since the output, being not purely sinusoidal, can be analysed into a fundamental and a number of harmonics; it is sometimes called harmonic distortion. An amplifier free from amplitude distortion may be found to give an amplification which varies with the frequency of the sinusoidal input. This is frequency distortion. If the input and output are compared, it may be found that they are not exactly in phase. This is phase or delay distortion. The signal at the amplifier may be added to by other and false components which may be either periodic (hum) or of a random nature (noise).

All four forms of distortion, except noise and hum originating in the first stage, can be reduced by a factor of 100 or more at the expense of amplification by negative feedback. Unfortunately, as far as the author is aware no commercial units are available which incorporate negative feedback and also give sufficient amplification for strain gauge work.

In practice, the most serious form of distortion is almost always phase distortion, owing to phase advance of the lower frequency components of the signal caused by the coupling condensers.

As in the case of static measurements, there are numerous bridge circuits, the majority using the principle of the a.c. bridge. It is possible to solve many problems by using the simple d.c. bridge together with a high resistance in the bridge circuit, and replacing the galvanometer by a cathode ray oscillograph (C.R.O.). In this type of circuit the changes of resistance are converted into changes of potential difference, these changes being passed to the amplifier by a condenser which isolates the amplifier from the mean d.c. potential difference. For the d.c. bridge the bridge voltage is given by:

$$Vg = \frac{E\,\delta r}{2M(2+M+R/Rg)}$$

where R = resistance of remaining two bridge arms (if different from M, the gauge resistance), δr = change of gauge resistance, Rg = galvanometer resistance, Vg = bridge voltage applied to galvanometer, E = bridge supply voltage.

Assuming that all four arms of the bridge are equal and have a resistance of 2,500 Ω each, the formula becomes

$$Vg = \frac{E\,\delta r}{4M(1+M/Rg)}.$$

In the case of a.c. measurements Rg is the input impedance to the first valve of the amplifier and has the usual value of 40 kΩ and 250 kΩ; thus in the a.c. case the Rg term will generally be negligible. This being so, we may say that $Vg = E\delta r/4M$ for all practical purposes.

Allowing the usual maximum current of 4 mA, for gauges of resistance 2,500 Ω, the voltage $E = 4 \times 2{\cdot}5 = 10$ V.

If the maximum strain anticipated is about 0·0015 and $\delta r/M$ is 0·0034, Vg from the above equation $= 10 \times 0{\cdot}0034/4 = 0{\cdot}0085$ V. Thus if a voltage of 100 V is required to produce full scale deflection of the trace, Vg must be boosted to this value by the amplifier with a gain of $100/0{\cdot}0085 = 12{,}000$ approximately.

Another important factor in connection with dynamic measurements is the elimination of interference caused by stray electromagnetic or electrostatic fields near the gauges. This is commonly called noise and to a large extent limits the sensitivity of the bridge circuit.

Referring to the gauge resistance as M, it has been shown that an electrostatic field will produce a definite current of noise frequency through the gauge; if this noise is expressed as a voltage it will be proportional to M and the ratio of signal to noise will be independent of M.

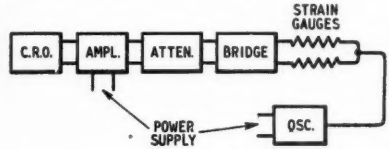


Fig. 1—Schematic diagram of system

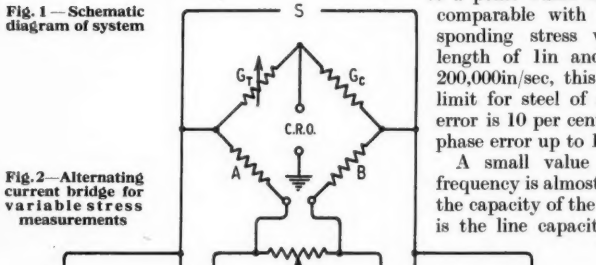


Fig. 2—Alternating current bridge for variable stress measurements

In the case of the electromagnetic field, an induced voltage is usually produced in series with the gauge; the noise-to-signal ratio can therefore be improved by increasing the value of M, although it cannot be increased indefinitely.

Electrostatic noise may be minimized by careful shielding of the circuit line and of the gauge itself, twin lead-covered cable being best for this purpose. The amplifier end only of the sheath should be earthed and the remainder should be insulated from any apparatus in contact with earth or having appreciable capacity to the source of the noise. The ends of the gauge should be insulated and the amplifier end of one cable should be earthed.

Noise from electromagnetic pickup may be largely obviated by using concentric cable, although for practical purposes twin lead-covered will suffice. The connections at the gauge end should be such that the two leads enclose a minimum area, in order to keep inductance to the minimum. Care should also be taken to see that the connections do not form a loop which encloses any magnetic field or material.

Frequency Limitations

The N.P.L. confirms satisfactory operation at frequencies up to 50 kc/s based on the assumption that the gauges will operate up to a point where the gauge length becomes comparable with the length of the corresponding stress waves. Taking a gauge length of 1in and a velocity of sound of 200,000in/sec, this means a practical upper limit for steel of about 50 kc/s, when the error is 10 per cent. There is, however, no phase error up to 100 kc/s.

A small value for the upper limit of frequency is almost always set in practice by the capacity of the leads to the gauge. If K is the line capacity it can be shown that $WKLM = 0{\cdot}45$ approx., where W = frequency limit, K = capacity of leads, L = length of leads, M = gauge resistance. Thus where K cannot be reduced sufficiently, an improvement in high frequency response may be obtained by reducing M.

Special low capacity cable will have a

capacity of about 15 μF/yd; for a gauge of 500 Ω and $W = 2 \times 50{,}000$, this gives a length of 40 yd and an error at 50 kc/s of 5 per cent. The capacity of ordinary lead-covered cables is much higher, so the maximum length will be about 1 yd for the same frequency limit. It will be readily agreed that frequency limits of the order of 50 kc/s will not occur often in practice, so for most applications (2 kc/s to 5 kc/s) a much longer length of cable may be used.

The A.C. Bridge

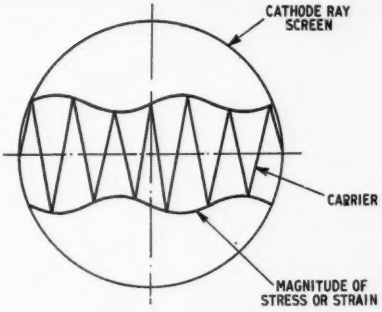
Two fundamental changes have to be made for a bridge to operate on a.c., the first being to suit the requirements of the oscillator which feeds it and the second the C.R.O. in place of the galvanometer. In general the amplifiers incorporated in the C.R.O. have not sufficient gain to produce maximum sensitivity so an additional amplifier must be used. A schematic diagram of the whole arrangement is shown in Fig. 1.

The bridge alterations consist mainly of providing suitable condensers in parallel with the arms to bring about reactive balance. The amount of reactance required is best found by trial and error, and in the bridge of Fig. 2 condenser tappings are included for this purpose. If the bridge is not balanced reactively it is impossible to obtain a straight line on the C.R.O. due to a sinusoid proportional to the reactive component persisting.

The amount of gain required from the amplifier may be adjusted by the attenuator. It is essential in the first instance to determine the deflecting voltage of the C.R.O. and to estimate the stresses to be measured. Having done this the gain of the amplifier may be adjusted.

Calibration is carried out by applying a small signal to the amplifiers and observing the deflection on the screen. In practice it is only found possible to observe the peak to peak amplitude of the resultant wave. The input signal will only have a known value in r.m.s. or average terms and unless the wave form is a pure sinusoid appreciable errors can occur. Wave form distortion can also occur in the amplifiers and so the measurement of peak values becomes complex. A useful method is to determine the sensitivity of the C.R.T. and gain of the amplifier independently. Measurement of the C.R.T. is simple and may be carried out with a voltmeter and 100 V d.c.

Fig. 3—Illustrating the carrier method of measurement



The amplifier gain can be determined by balancing it against the loss of the attenuator which for simplicity may consist of two variable resistances in series. The oscillator for applying the signal should have a peak output of about 50 to 100 V. The frequency response of the instrument should be adjustable over the working range, but a fixed frequency in the range of 250 to 2,500 c/s will be suitable. The purity of waveform is of no importance.

For the purpose of calibration the oscillator is first connected to one X plate and one Y plate; the other plates are earthed and connected to the earthed side of the oscillator. On applying a p.d., a 45 deg sloping line is seen on the screen. This line should be traced for comparison later. The Y plate is then disconnected from the oscillator and the amplifier connected to the output side of the tube, the input to the amplifier being fed through the attenuator from the oscillator. The X plate connections are left unaltered. Again a sloping line appears on the screen and by adjusting the Y shift and the attenuator this line may be made to coincide with the one previously traced. It is possible to make the slope of the trace and the 45 deg line approximate closely even in the presence of considerable disturbance.

Carrier Method

In the a.c. carrier method the bridge is again fed from an oscillator, the frequency depending on the highest frequency stresses it is proposed to investigate. It is essential that there should be sufficient peaks to enable an accurate outline of the envelope to be obtained; once the frequency has been

chosen and a test commenced, it should not be raised until the test is over. The bridge output is fed through the amplifier to the Y deflection plates and when the bridge is balanced a horizontal line will be seen on the screen. If the bridge is now unbalanced by a small amount at constant magnitude, a sinusoid will appear on the screen, of the same frequency as the bridge supply (see Fig. 3).

The amplitude of the sinusoid will be directly proportional to the unbalance of the bridge and if the out of balance current is varying, as will be the case when transient or vibratory stresses are being measured, the sinusoid will be modulated so that the amount of modulation is directly proportional to the vibration in the out of balance.

The most satisfactory way of avoiding distortion of low frequency, or transient phenomena, is to supply the bridge with a.c. of about 1,000 c/s. The out-of-balance signal then has the form of a 1,000 c/s a.c., modulated by the phenomena it is desired to record. The simplest arrangement is to record the modulated wave directly after amplification, but in some cases it is preferable to add a rectifier so that the modulating wave form is obtained directly and the modulated wave or carrier eliminated.

This method renders negligible the errors due to frequency and phase distortion. If the signal is a sinusoidal variation of frequency Fs and the a.c. supply to the bridge has a frequency Fc then the output from the bridge is $(a + b \cos 2\pi Fs) \cos 2\pi Fc$, where "a" is a constant representing the output when the gauge is unstrained and "b" is the strain of the gauge. This equation becomes $a \cos 2\pi Fc + \frac{b}{2} \cos 2\pi (Fc + Fs) \frac{b}{2} \cos 2\pi (Fc - Fs)$.

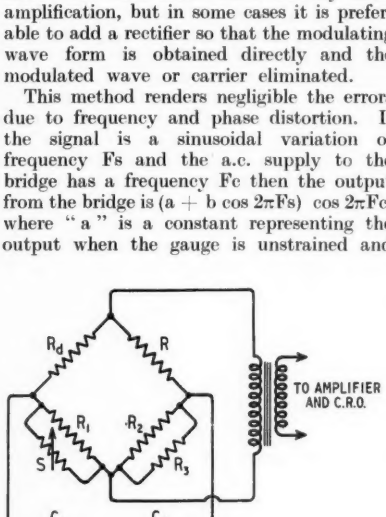


Fig. 4—A further a.c. bridge used for alternating stress measurements

The original signal frequency Fs has thus been replaced by two new frequencies (Fc + Fs) and (Fc − Fs) and by suitable choice of Fc both can be made to have values that a normal amplifier will handle with negligible distortion.

If the signal is not sinusoidal, it can be analysed into its component frequencies and if Fs is the highest the amplifier must handle a frequency band 2Fs wide with its centre at Fc. As Fs becomes lower the width of the band reduces so there is no difficulty with low frequency signals.

If the bridge is exactly balanced initially, so that $a = 0$, the output is $b \cos 2\pi Fc$. Cos $2\pi Fs$ and the sign of $2\pi Fs$, whether the strain is initially tensile or compressive, cannot be determined because $\cos 2\pi Fc$ is varying cyclically. In other words, one cannot tell whether the upper or lower envelope is the correct one. To avoid ambiguity it is usual to arrange so that "a" has a value slightly greater than "b."

Although the use of a.c. solves most of the amplifier problems, it introduces a complication and risk of error because a bridge circuit, when balanced for d.c., is not necessarily balanced for a.c. because of the presence of capacities and sometimes inductances also, which, of course, are without effect upon the d.c. balance. Alternating current bridges may be divided into two general classes; those in which balance depends on supply frequency and those in which balance is independent of supply frequency.

Another form of a.c. bridge using variable condensers to achieve the conditions set out above is shown in Fig. 4. For calibration, one of the ratio arms may be changed by an amount corresponding to a known strain by any of the methods already described. It is important to note that the two ratio arms must be non-inductive.

Recording Systems

In order to examine phenomena which last for some seconds, it is almost essential to use a moving film camera, whereas for shorter periods a drum camera can be used.

When only one record is required, a C.R.O. is probably most useful as synchronizing marks can be added to the record in a number of ways, such as by momentarily extinguishing the spot or by abruptly displacing it sideways. A time scale is automatically provided by the a.c., provided it is of known frequency and the film speed is fast enough to resolve the separate cycles. Alternatively, if synchronizing marks are not required, or if there is no risk of confusion, the spot can be regularly extinguished or displaced sideways to provide a time scale. Except with a double beam tube, which permits the recording of two phenomena quite easily, the provision of multiple records on a common film involves fairly complex mechanical and optical layout.

For many engineering purposes, high speed mechanical oscillographs are useful since they facilitate the recording of numerous phenomena. They are commonly moving coil galvanometers designed and constructed to have a high natural frequency, but there has recently been developed a piezo-electric oscillograph, which has a somewhat higher frequency. Nearly all these instruments employ photographic recording, but there are a few moving coil instruments which give a pen record. These are obviously more convenient for many purposes but are only suitable for lower speed operation.

Electricity in the '51s

Some Noteworthy Centenaries

By G. J. S. KING

FRENCH politics and Australian gold shared the responsibility for interrupting the careers of two famous electrical pioneers a century ago. Eighteen hundred and fifty-one was the year of the *coup d'état* of Louis Napoleon in France and among the Frenchmen exiled in consequence was Wilfrid de Fonvielle, who invented several electrical instruments, and discovered "rotary magnetic fields." Meanwhile Edward Davy, who had become famous in England by his experiments in electric telegraphy, but had lost a fortune by emigrating to Australia, had achieved new prosperity as the manager of copper-smelting works. But the discovery of Australia's gold that year denuded the works of its employees and Davy's position was again precarious until he received a Government appointment.

Towards the end of 1851 a *Punch* cartoon depicted John Bull and a typical Frenchman as "The New Siamese Twins," bound indissolubly together by electric wire, although one stood at Calais and the other on the cliffs of Dover. This was the new *entente électrique*, which was inspired by the establishment of telegraphic communication between Dover and Calais, after the snapping of the original cable in the previous year. Guns fired at Dover by communication from Calais announced the historic event, and the inauguration of the "postman of the waves" was suitably celebrated on both sides of the Channel.

Contemporary reports announced that the binding of the "electric tie" would be commemorated by a *fête*: "Prince Albert is to flash an electric spark from London, which is to fire off a cannon at the Invalides; and Louis Napoleon, by the same means, is to fire off a cannon at the Tower of London."

Britain was becoming "electricity conscious" in those days, and was even getting excited about experiments in "electro-biology." There was a sly dig in *Punch's* contrast of "the days of the slow coaches with a period like the present, when, thanks to electricity, everything goes, *or promises to go*, exactly 'like clockwork'." The journal pointed out that in Stockholm all the public clocks were operated by electricity, and suggested a similar plan in London. The idea was "one grand central Electrical Clock"—say the Horse-Guards clock. The Horse Guards would thus become the "Grand Electrical Depot" to regulate the clocks throughout the country. "The electric fluid would be turned on

every morning with no more difficulty than the equivocal fluid which is given us as pure water by our water companies. Differences as to Greenwich time, railway time and London time, would all cease "—and so *ad infinitum*.

Work of Faraday and Kelvin

Faraday was at the height of his fame in 1851. He enjoyed in science a status comparable with the dignity of an "elder statesman" in politics. Meanwhile Kelvin (then Professor Thomson) was knocking loudly at the door of fame. It was in that year that he delivered his famous papers on the dynamical theory of heat and kindred subjects, including one "On Applications of the Principle of Mechanical Effect to the Measurement of Electro-motive Forces and of Galvanic Resistances in Absolute Units," which linked up with the work of James Prescott Joule—a reminder that it was in 1851 that Thomson was associated with Joule in his papers on thermo-dynamics.

Fleeming Jenkin began his great electrical career that year; and William Spottiswoode published "Elementary Theorems relating to Determinants" (the first treatise on determinants). The system which perpetuated the name of Samuel Morse was adopted in Germany. It was the year of Vail's electric locomotive; of the establishment of Reuter's telegraphic news service in London; and of the exhibition of Staite's "electric illumination" at Manchester. Perhaps the most important of the "electric episodes" of the year was, however, the invention of Ruhmkorff's induction coil, which was of immense value to every electrician and eventually won a special prize offered by Napoleon III.

The centenary, on 9th March, of the death of Hans Christian Oersted, recalls a great Danish physicist, who was famous for his work in electro-magnetism. Another celebrity who died in 1851—on 28th June—was John Murray, who was the author (as far back as 1830) of a "Treatise on Atmospherical Electricity," and also published a work on the lightning conductor.

Famous Men Born in 1851

With the notabilities born during 1851 we recall men who will in some cases be a vivid personal memory instead of mere names in history. Sir Oliver Lodge, for example, was born on 12th June that year, and will be remembered above all, perhaps, as a pioneer in wireless telegraphy. His first important work was "Modern Views of Electricity," which was published in 1889, and his other publications included "Lightning Conductors and Lightning Guards," "Electrical Precipitation," "Ether and Reality," etc.

Silvanus Phillips Thompson was exactly a week younger than Sir Oliver Lodge, and became President of the Institution of Electrical Engineers in 1899. His position as a pioneer in the development of applied electricity is unassailable, and his "Elementary Lessons in Electricity and Magnetism" and "Dynamo-electric Machinery," both of which were published in the 'eighties, were standard text-books for many years. His principal achievement, however, was his work in encouraging electrical engineering education.

Other Investigators

There will be many personal memories of Sir Arthur Schuster, who was born on 12th September, 1851, and among whose outstanding activities were his investigations of the electric discharge in gases, terrestrial magnetism, calorimetry and radiometry. Sir David Lionel Salomons, who was born in the same month as Lodge and Thompson (on the 28th) was vice-president and treasurer of the Institution of Electrical Engineers, and chairman of the City of London Electric Lighting Company. He was a practical experimenter and inventor, and his "Electric Light Installations" ran through many editions.

Yet another notability born in June a century ago (on the 15th) was Ernest Howard Griffiths, who, like Lodge, Thompson and Schuster, was a noted educationist, and was author of "The Thermal Measurement of Energy." He contributed scientific papers to the *Transactions* of the Royal Society on subjects connected with heat and electricity.

Two outstanding celebrities were born in the month of August a century ago. George Francis Fitzgerald (3rd) was a noted Irish physicist, whose investigations into electric waves and radiation resulted in the Lorenz-Fitzgerald hypothesis. His publications dealt chiefly with the electro-magnetic theory of the reflection and refraction of light, and his researches in electrolysis resulted in notable discoveries. Sir John Davison Milburn was one day younger than Fitzgerald, and was chairman

of the Newcastle & District Electric Lighting Co., Ltd., and of the Northern Counties Electricity Supply Co., Ltd.

Professor Fitzgerald was largely influenced by the great Clerk Maxwell, and so was George Chrystal, the eminent mathematician, who was born on 8th March, 1851. Chrystal experimented under Clerk Maxwell—especially in the verification of Ohm's law—and he wrote on electricity and magnetism in the *Encyclopædia Britannica.*

The centenary, on 20th May, of the birth of Émile Berliner, recalls the inventor of the "loose contact telephone transmitter" and of the "induction coil connected therewith," which was of first importance in the development of practical telephony. He was also the inventor of the gramophone. Yet another celebrity born in 1851 (on 24th September) was Philip Cardew, an officer in the Royal Engineers, who devoted his life to the application of electricity to military requirements. He was a pioneer in the construction of electric searchlight apparatus and was the first electrical adviser to the Board of Trade, being subsequently engaged in the electrical industry, and becoming vice-president of the Institution of Electrical Engineers. He was the inventor of galvanometers and of the vibratory transmitter for telegraphy.

As in 1851 Faraday was at the summit of his fame, so in 1751 John Canton, "one of the most successful experimenters in the golden age of electricity," was a leading name in electrical research. He became a member of the Council of the Royal Society that year, and was awarded the Society's Copley Medal. In that same year (Sir) William Watson, who shared eighteenth-century fame as an electrician with Canton (and was described by Joseph Priestley as "the most interested and active person in the kingdom in everything relating to electricity") was conducting his investigations.

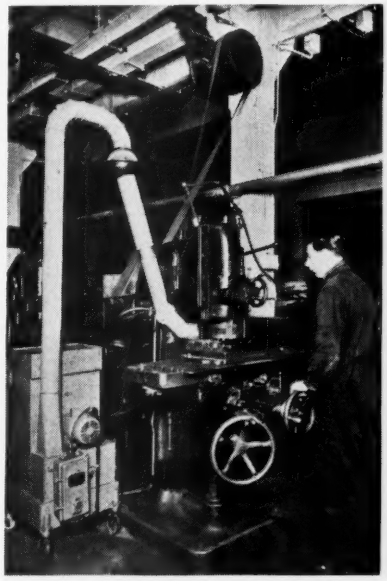
A greater name than either Canton's or Watson's was, however, that of Benjamin Franklin, who, varying his scientific activities with politics, became in 1751 a member of the Pennsylvania General Assembly. And it was in 1751 that the important magnetical researches of Gowin Knight were recognized by the official testing of his improved compass.

There are two other notable names in the year's bicentenaries. Andrew Gordon, who died on 22nd August, 1751, was famous for his experiments in electricity, and was the first electrician to use a cylinder instead of a sphere. It was said that he was "enabled to excite the electricity of a cat so strongly that the force, communicated by iron chains to spirit of wine, set it on fire."

Benjamin Robins died on 29th July in the same year as Gordon. He was a mathematician, a politician, an authority on fortifications, and a pioneer in gunnery; and his works included "Experiments showing that the Electricity of Glass disturbs the Mariner's Compass, and also nice Balances."

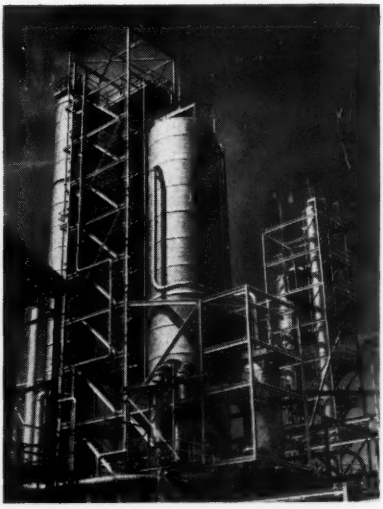
Cast Iron Dust Collection

MACHINING operations on cast iron cause a considerable dust and dirt nuisance. This can be eliminated by installing "Drytex" and "Drymat" unit dust collectors recently made available by Dallow Lambert & Co., Ltd., Spalding Street, Leicester. The "Drytex" is a portable collector with a high velocity patent universal fitting while the "Drymat" heavy-duty unit has a counterbalanced overhead canopy type hood. In each case, the cleansed air is recirculated and does not impose any extra load on heating.



"Drytex" portable iron dust collector in use

Electricity in the Oil Industry—VII



Crude distillation unit at the new Shell refinery at Cardon on the Paraguana Peninsula, Venezuela

Further Electrical Applications at Refineries

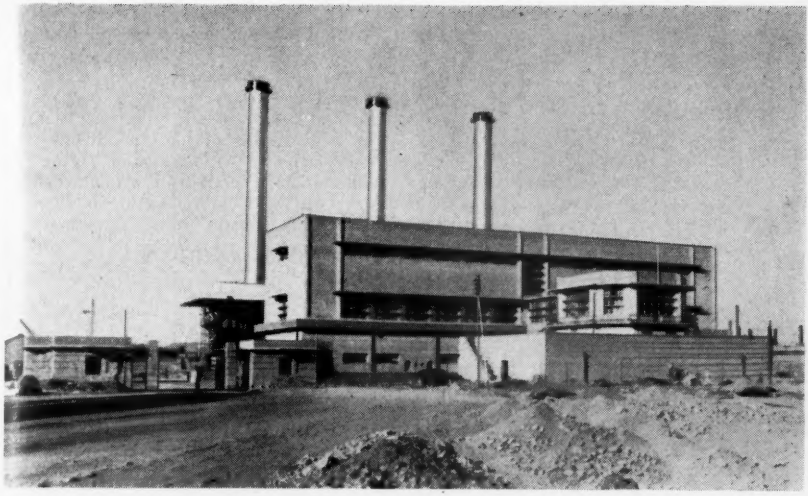
THOUGH still in its early stages—it is scheduled to start operation at the end of 1951—the Anglo-American Oil Co.'s refinery at Fawley on Southampton Water is of especial interest in that provision is being made for the use of pressurized control rooms. This plant, which it is claimed when completed in January, 1952, will be the largest refinery in Europe, will have an output of 110,000 barrels a day or 5½ million tons a year. A power demand of 16,000–17,000 kVA is anticipated, with an annual consumption of 100 million kWh and a load factor as high as 80–85 per cent.

Being a joint British-United States venture, the plant as originally planned provided for the use of a high proportion of American plant, it being thought at the time that British manufacturers were not in a position to produce it in time. Actually, however, British deliveries have been so good that many of the original contracts for American plant have been cancelled and British equipment has been substituted, so that approximately 80 per cent of the electrical plant will be British made, largely by the Metropolitan-Vickers Electrical Co., Ltd. This ability to use British equipment is greatly welcomed by the oil company as it considerably facilitates maintenance.

The refinery at Fawley will be entirely dependent on electricity from the grid, a double circuit 132 kV line being brought from the main B.E.A. substation at Nursling through a ring busbar system to two 15 MW 132/11 kV transformers. Each supply and each transformer is capable of carrying the whole load of the refinery. The 11 kV supply is being taken to seven substations situated in safe areas towards the edge of the refinery site. The largest, serving the salt water pump, will have a capacity of 10,000 kVA, while four of 5,000 kVA capacity will feed the boiler house, the pipe stills station, the catalytic cracking plant and other process units, and the products loading pump house. The jetty and warehouses will require 625 kVA, and the administration block 625 kVA. A 3,000 kVA supply is being provided for the constructional work.

So far as possible the operation of the plant will be automatic. Automatic transfer operation will be provided in all the main substations and practically every item of plant is duplicated. Special fire fighting precautions provide for the inclusion in the telephone system (Automatic Telephone Electric Co.) of fifty priority lines giving immediate audible and visible warning on the special board in the fire station.

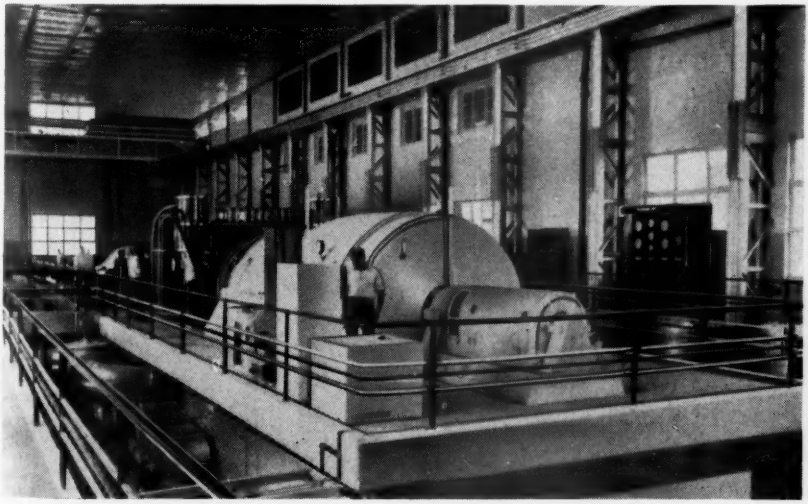
All pumps are placed outside the buildings in the open air, not under cover. Up to 150 h.p. the motors are run on 415 V; above that on 3 kV, the largest machines being 1,250 h.p. units driving the salt water pumps. Every process unit motor is operated by means of explosion proof push-

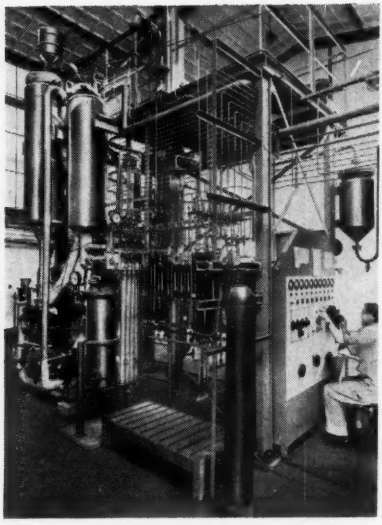


Kirkuk "B" power station (Iraq Petroleum Co., Ltd.) showing (below) two B.T.H. 18,750 kW 3,000 r.p.m. turbo-alternators

buttons, the contactors being grouped in three pressurized buildings in which the air is admitted through an air duct extending 40ft above grade. The air in the buildings is kept at 2in w.g.

Apart from the refinery itself the scheme envisages the erection of a number of houses for workpeople. Already a cinema/theatre (500 seats) with reading room, sports centre, etc., has been completed to provide entertainment, Fawley being about 15 miles from a large town.



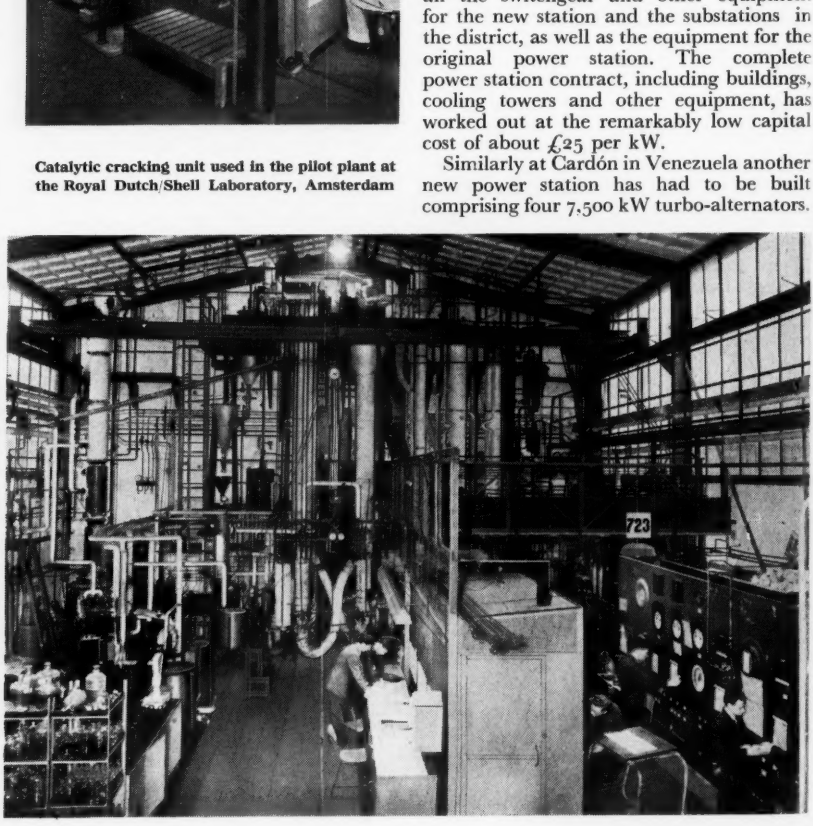


Catalytic cracking unit used in the pilot plant at the Royal Dutch/Shell Laboratory, Amsterdam

Private Generating Plant

While the availability of adequate public supplies renders the local private generation of electricity unnecessary in this and other industrialized countries except perhaps as a precautionary measure, this is not the case in the newly developed oilfields and refinery areas. At Kirkuk in Iraq, for example, where apart from a small distillation plant for local requirements there is a stabilization plant for the treatment of crude oil before it is pumped to the coast, a complete new power station has had to be erected by the Iraq Petroleum Co., Ltd. For this station, which is arranged to burn either natural gas or oil, three 18,750 kW turbo-alternators are being supplied by the B.T.H. Co., which was also responsible for all the switchgear and other equipment for the new station and the substations in the district, as well as the equipment for the original power station. The complete power station contract, including buildings, cooling towers and other equipment, has worked out at the remarkably low capital cost of about £25 per kW.

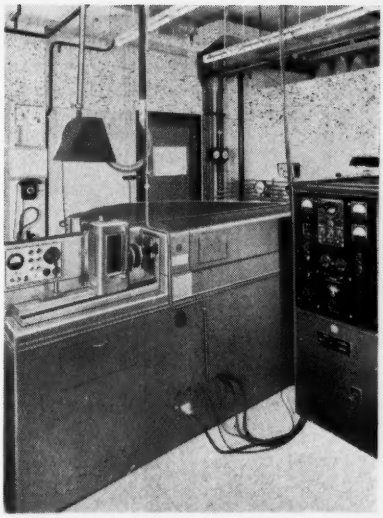
Similarly at Cardón in Venezuela another new power station has had to be built comprising four 7,500 kW turbo-alternators.



The English Electric Co., Ltd., which was responsible for this plant, is also carrying out similar installations at Balik Papan in Indonesia (four 7,500 kW sets) and at Abadan in Iran (two 31·5 MW sets). Incidentally the comprehensive range of standard equipment supplied by this company for installation all over the world includes flameproof motors up to 130 h.p. and transformers of outdoor, hermetically sealed and small flameproof types (500 and 250 VA) for low voltage lighting and tools. The h.v. and l.v. switchgear and control gear for the plants at Cardón and Balik Papan were supplied by the Yorkshire Switchgear & Engineering Co., Ltd.

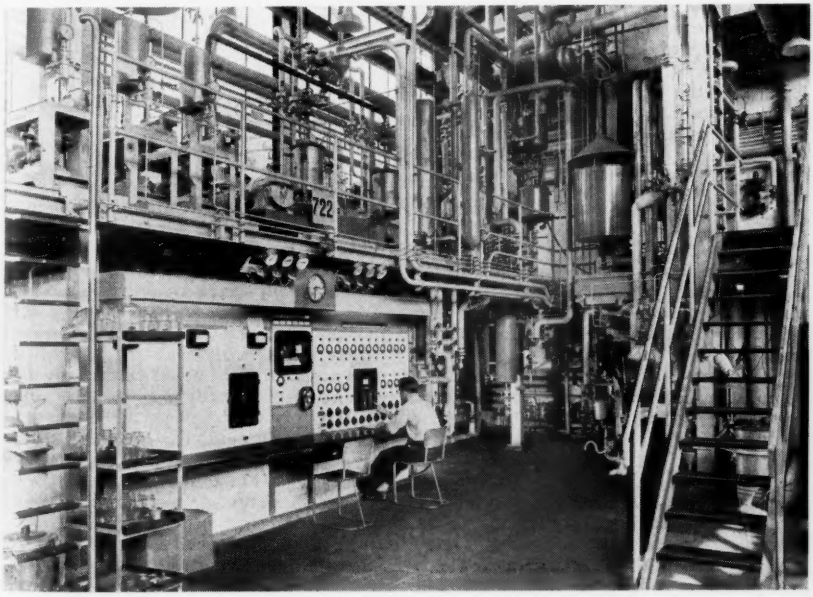
Good Lighting Necessary

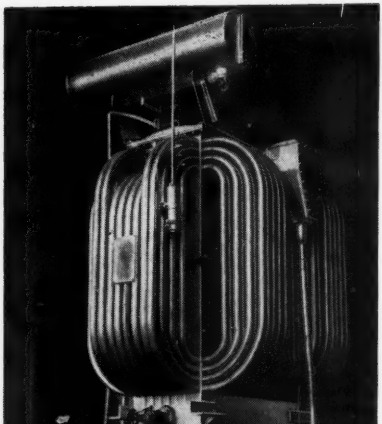
Although this does not apply to the installations we have visited, we are told that there is one feature to which some of the oil companies might to their advantage pay greater attention, namely lighting. In some of the refineries it is apparently conspicuously bad. This is rather surprising since poor general lighting necessitates the use of portable lamps which introduce a further potential (even if unlikely) source of danger which might well be avoided.



Spectrograph apparatus used at the Royal Dutch/Shell Laboratory

Topping unit in pilot plant at the Laboratory





Transformer at the new power house, Cardon refinery

Special flameproof floodlights have been developed by the G.E.C. to take 500 W or 1,000 W lamps, also 60–200 W.

In addition to the production plant there is a vast market for domestic appliances for the use of the personnel employed. This applies especially in the case of the newly developed areas abroad where there is a demand for fans, air coolers, etc., as well as the apparatus commonly used in this country.

Sampling and Testing

So far we have dealt principally with the use of electricity as applied to the actual operational working of the oilfields and refineries. There is, however, another extremely important range of applications which are employed even before the drilling commences, right through the whole series of pumping and refining processes up to the completion of the finished products. We refer to sampling and testing of sample materials. Several of the devices used we saw at the Royal Dutch/Shell Laboratory at Amsterdam, others at the manufacturers' works.

For detecting oil bearing strata a means has now been developed to eliminate the necessity of bringing samples of the core and the removal of the boring tools, namely by inspecting the drilling fluid or cuttings by fluorescent lamps. Every ten minutes samples of material are inspected under a "Philora" lamp from which all rays have been filtered off except those of 3,650 A°. With the aid of barrier layer photocells the intensity can be measured by a galvanometer.

Under the alternative Schlumberger system two pairs of electrodes are lowered down the drilling hole, a high resistance recorded between them generally indicating the presence of oil. Another method of detection employs the use of gamma rays, dense rock reflecting the rays which can be detected on a Geiger Müller counter. Neutron rays used in conjunction with electronic devices can be used similarly.

Well-equipped Laboratories

In the laboratories use is made of practically every type of electrical instrument—ultra-violet, infra-red and X-ray equipment; instruments for controlling, measuring and recording temperature, pressure, vacuum, etc.; spectrometers and spectrophotometers; comparator densitometers; electronic counters; oscilloscopes; recording potentiometers; valve testers, etc., as well as ovens, autoclaves, centrifugal mixers, etc. A very high proportion of the apparatus is British made and one particularly valuable new aid is a "Metrovick" mass spectrometer which can be employed, for example, to show immediately on an oscilloscope the percentage and mixture of gases from every tapping of a catalyst chamber. Up to fifteen components can be dealt with simultaneously—a considerable advance on the previous infra-red methods capable of handling only three or four components. Two other specially interesting Grubb Parsons instruments employed are an "Irga" gas analyser and an infra-red apparatus for the optical qualitative measurement and recording of radiant energy.

To supply a constant voltage required for certain tests provision is made for a regulated power supply. Further extensive use is made in the laboratories of many of the heating processes normally undertaken by steam.

We thank the Shell and B.T.H. Companies for supplying the photographs used in this article.

VIEWS on the NEWS

By REFLECTOR

WHEN I mentioned some time ago that a local newspaper had had difficulty in obtaining information about an electricity breakdown in a Surrey district I was assured by the secretary of the South Eastern Electricity Board that local managers had been told that they were at liberty to give such information. It seemed that there had been a misunderstanding. The *County Express*, Stourbridge, reports similar difficulties encountered during a recent breakdown. Once again, the Electricity Board (in this case the Midlands Board) had given a free hand to its local representatives but there seemed to be some doubt as to whose job it was to talk. There is an ever-present danger with nationalization that even if the men at the top favour freedom of speech for those in the lower branches of the tree the latter are fearful of saying too much. Encouragement from the Boards should be more positive.

* * *

In last Sunday's " Round Britain Quiz " in the B.B.C.'s Light Programme the London team was asked to state the significance of " V equals A divided by R " and various combinations of these symbols. Naturally I spotted at once that it was Ohm's law in a somewhat irregular form and the Londoners also got it after a little ratiocination. What surprised me in the discussion of the question was the hesitation shown by these first-class brains in the naming of the units, particularly that of resistance. I thought that they were common currency in this electrical age.

* * *

Why does it take so many men to install an electric cooker in some areas? Recently I referred to a report that twelve men were engaged in one particular instance. Speaking at a meeting at Bagshot, Mr. R. Lonsdale, manager of the Bracknell District of the Southern Electricity Board (reported in the *Woking News*) said it was his aim to simplify the way in which work was done. He recalled that when working for a private authority he had attempted to reduce the number of men (twelve) required to install one electric cooker. He eventually managed to get it down to six, but had great difficulty and to some extent had the trade unions against him. He admitted that not all of the trouble was due to trade unions. " Our industry is so complex you cannot have one man capable of performing all the functions necessary."

* * *

I have no doubt that the switching on of electric fires during peak hours is a major factor in creating excessive peaks but an impression is being built up that the use of electric fires at all is sinful. Consequently, I am glad to learn from the *Stockport Express* that Mr. O. Howarth, chief engineer of the North Western Electricity Board, has spoken up in favour of this valuable and much-maligned method of heating. In a statement issued at a recent meeting Mr. Howarth said :—

> " If you are warming a room of normal size for about five hours during an average winter evening, the amount of electricity you consume will be provided by about 15 lb of low-grade fuel burned in a power station. If you warm it by a coal fire you will burn more than 15 lb of higher-grade fuel."

* * *

The B.E.A. appears to run into riparian and marine troubles fairly frequently. It has even been accused of parboiling fish with the water from its cooling systems. Now it has been accused by the Avon and Dorset River Board of contemplating heavy chlorination at Poole to prevent mussel spawn getting into the works at the new power station there. It seems, however, that the Authority is so far merely investigating the possibility of mussel growth in the surrounding water. An assurance has been given that chlorination, if used at all, would not be harmful to the mussel population.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE board of directors of Electric & Musical Industries, Ltd., has appointed **Sir Ernest Fisk** governing director of Electronic Tubes, Ltd.

The Railway Executive announces that, with the concurrence of the British Transport Commission, **Mr. H. H. Swift,** B.E., M.I.E.E., executive officer (electrical engineering, new works and development), Railway Executive headquarters, has been appointed mechanical and electrical engineer, Southern Region, as from 1st January. Mr. Swift was educated at St. Peter's College, Adelaide, South Australia, and at the University of Adelaide. He subsequently entered the works of Siemens Schuckert, Berlin, and at the outbreak of the 1914-1918 war was interned as a civilian prisoner of war at Ruhleben. After the war he joined the English Electric Co., Ltd., and was employed on important electric traction schemes in Japan, South Africa, Denmark and Poland. In 1936 he was appointed assistant electrical engineer with the L.N.E.R., became assistant chief electrical engineer in 1941 and in 1948 was made electrical engineer (acting), Eastern and North Eastern Regions, British Railways, becoming executive officer, headquarters, in March, 1950.

Mr. H. H. Swift

Sir John Kennedy, O.B.E., M.I.C.E., M.I.E.E., who was acting chairman of the Uganda Electricity Board during part of Mr. Westlake's absence on leave, has now returned to the United Kingdom. Shortly after Mr. Westlake's return Sir John was taken seriously ill and this delayed his departure. He is now making good progress.

Mr. P. E. Simmonds, A.M.I.E.E., at present district engineer with the East Midlands Electricity Board at Loughborough, informs us that he has been appointed distribution transformer sales engineer with Gresham Transformers, Ltd., Hanworth, Middx. He has previously held appointments with the Leicestershire and Warwickshire Electric Power Co., Blackpool Corporation Electricity Department, and the Yorkshire Electric Power Co. Mr. Simmonds takes up his new duties on 1st February.

Mr. P. Wardle, A.M.I.E.E., district manager at Cannock for the Midlands Electricity Board, retired at the end of 1950 on completion of forty-eight years' service in the electricity supply industry. Before vesting date he was the chief engineer and general manager of the Cannock U.D.C. electricity undertaking, and before that served in the municipal undertakings of the Corporations of Walsall, Carlisle, Rawtenstall and Rochdale. From 1936 to 1939 he was a member of the I.M.E.A. Council and in 1938-1939 was chairman of the Central England Area Committee of E.D.A. Mr. Wardle will continue to reside in Cannock.

Mr. K. A. Zandstra, head of the High Frequency Department of Philips Electrical, Ltd., has been awarded the Bessemer Premium by the Society of Engineers for his paper entitled "High Frequency Heating in Industry." The presentation will take place on 5th February on the occasion of the presidential address.

Sir Edward Wilshaw has been appointed a director of the Oriental Telephone & Electric Co., Ltd.

Mr. A. G. Ramsey, O.B.E., B.Sc.(Eng.), M.Inst.C.E., M.I.E.E., M.I.Mech.E., who retired from the position of chief engineer to the Ministry of Works at the end of December, had been in the Ministry since 1914 when he was appointed district engineer, Scotland. He held this post until 1919 when he became assistant engineer at headquarters. From 1920 to 1924 he was acting deputy chief engineer, and for a further twelve years was engineer in charge of special works. He was appointed deputy chief engineer at the Ministry of Works in 1936 and became chief engineer in 1941. Mr. Ramsey was on the General Council of the British Standards Institution from 1944 to 1947 and is a member of

Mr. A. G. Ramsey

various B.S.I. Committees. He was chairman of the Installations Section of the I.E.E. in 1943-44, and was elected president of the Association of Supervising Electrical Engineers for 1948 and 1949.

Pirelli-General Cable Works, Ltd., has appointed **Mr. B. O. Ashford,** B.Sc., D.I.C., A.R.I.C., F.Inst.Pet., as development engineer, Eastleigh Works. This is a new appointment, and his duties will include co-ordination of all development work within the factory, and liaison with technical and scientific institutions. Mr. Ashford joined the company in 1929 as chief chemist, a position to which he will now be succeeded by **Mr. A. N. Coffin. Mr. R. Newman,** B.Sc., will assist Mr. Ashford in his new duties.

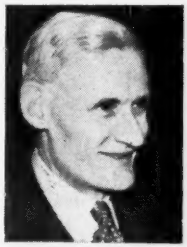
Sir Thomas G. Spencer, M.I.E.E., managing director of Standard Telephones & Cables, Ltd., has been elected chairman of the company. He succeeds the late Sir Frank Gill. Sir Thomas has been with Standard Telephones and Cables, Ltd. (formerly the Western Electric Co., Ltd.) since 1907, and was called upon to take charge of the company in 1932. He will continue in the capacity of managing director in addition to holding the office of chairman. Sir Thomas received his knighthood in the New Year Honours of 1946. In addition to his appointments with Standard Telephones & Cables, Ltd., he holds office in a number of the company's associated or subsidiary organizations. He is a director and vice-president of the International Standard Electric Corporation; chairman of Standard Telecommunication Laboratories, Ltd., Kolster-Brandes, Ltd., and the International Marine Radio Co., Ltd., and a director of Creed & Co., Ltd.

Sir Thomas Spencer

Mr. M. H. Hammill, B.Sc., A.M.I. Mech.E., director of Foster Transformers & Switchgear, Ltd. (one of the L.D.C. group of companies) has been appointed general manager. **Mr. B. L. Perkins,** B.Sc., A.M.I.E.E., the company's export manager since 1945, has been appointed general sales manager. He will continue to take special responsibility for export business, as will **Mr. P. C. Mortimore,** O.B.E., for home sales.

A luncheon was given to **Sir Harold Hartley** at the Dorchester Hotel by the British National Committee, World Power Conference, on 21st December to mark the end of his fifteen years' service as chairman of the International Executive Council and the British National Committee. **Sir Vincent de Ferranti** presided, and among those who attended were Sir John Dalton, Sir John Hacking, Mr. H. Hobson, Sir Guy Nott-Bower, Sir Johnstone Wright and Mr. C. H. Gray (secretary).

Mr. Harold Hobson has joined the board of the General Electric Co., Ltd. Mr. Hobson was with Messrs. Merz & McLellan and the County of London Electric Supply Co. before joining the Central Electricity Board as commercial manager in 1928. He was subsequently appointed general manager and he was chairman from 1944 until 1947 when the British Electricity Authority was set up.



Mr. Harold Hobson

Mr. F. D. Larcombe, A.M.I.E.E., formerly North of England district engineer for Callender's Cable & Construction Co., Ltd., and later site engineer with McLellan & Partners, has now joined the board of directors of Larcombe Bros., Ltd., consulting engineers, Liverpool.

Mr. T. A. Simpson has been appointed deputy general manager of the Marconi International Marine Communication Co., Ltd. Mr. Simpson joined the company as a member of the seagoing operating staff in 1913, and served in that capacity until 1917, when he was appointed to the instruction staff at Marconi House, London. He was later transferred to Southampton and in 1931 commenced service overseas at the company's Port Said depôt, remaining there until 1935, when he returned to Liverpool. In 1938 Mr. Simpson went to the Marconi depôt at Bombay as depôt manager. Returning to England in 1946, he was appointed assistant to the general manager (contracts), and in 1947 contracts manager (deep sea section). Mr. Simpson's office will be in Marconi House, Strand, London, W.C.2.

Mr. T. A. Simpson

Mr. E. Frost has been appointed secretary general of R.A.M.A.C. in succession to **Mr. J. Connell,** who is now retiring from the post, which he has held since the formation of the Association. R.A.M.A.C. (Radio Marine

Associated Companies) is a world organization of companies operating marine radio services. The resources of the member companies are co-ordinated to further the development of ships' radio equipment and aids to navigation. Although Mr. Connell's retirement takes effect from 1st January, he will assist Mr. Frost with his new duties for a time, and will accompany him to the next R.A.M.A.C. Conference, to be held in Oslo in May. Mr. Frost has been associated with marine radio for twenty-five years. His office will be at the R.A.M.A.C. headquarters, 109, Eaton Square, London, W.1.

Mr. A .C. Livesey, M.I.E.E., a director of the British Oxygen Co., Ltd., since 1941, retired from the board on 31st December, and has relinquished his position as director in charge of the company's engineering works at Edmonton. Before joining the British Oxygen Co., Mr. Livesey was joint managing director of Brbokhirst Switchgear, Ltd., Chester.

Mr. G. M. Akeroyd has joined Lancashire Dynamo & Crypto, Ltd., and has been appointed to the southern district of the London home sales staff. Mr. Akeroyd served his apprenticeship with the English Electric Co., Ltd., at Bradford, and was then employed for some years by the Marconi Co. as a wireless officer in the Merchant Navy. In 1930 he re-joined the English Electric Co., Ltd., as contracts engineer in the industrial motor sales office and remained there until being commissioned in the R.N.V.R. in 1939. Released from naval service in 1945 he again joined the English Electric Co., this time as sales engineer on the staff of the London office. Some three years later he became sales engineer for the South London territory of the Hopkinson Electric Co., Ltd., and at the end of 1949 he took over power sales interests south of the Thames for Veritys, Ltd.

Mr. L. J. Gooch, A.M.I.E.E., a director of Marryat & Scott, Ltd., has been elected chairman of the National Association of Lift Makers for 1951.

Mr. A. Law, who has been for the past eleven years manager of the Commonwealth Sales Department of Babcock & Wilcox, Ltd., has been appointed deputy sales manager. **Mr. J. S. Robertson,** who since 1941 has been manager of the New York office of Babcock & Wilcox, Ltd., has been appointed to succeed Mr. Law.

Mr. R. N. Cadbury, B.A., has been appointed sales director of E.M.B. Co., Ltd., West Bromwich and will be responsible for the internal sales organization.

Mr. H. A. Ashmawy, A.M.I.E.E., has been appointed estimator in the home sales department of the London office of Lancashire Dynamo & Crypto, Ltd. Mr. Ashmawy obtained his early training as an apprentice at the Witton Works of the General Electric Co., Ltd., and was appointed to the sales staff of that organization in 1943. Subsequently he became technical sales engineer at the Cairo offices of the G.E.C. In 1947 he was appointed chief engineer of the Transport & Engineering Co., Ltd., Cairo, a post which he retained until returning to this country two years later.

Mr. L. B. Dent, A.M.I.E.E., M.Inst.F., station superintendent at Islington generating station, has retired after over forty years' service in the industry. After an apprenticeship at Bedford, Mr. Dent joined the staff at the Watford generating station in 1909 and later transferred to Uxbridge. In 1915 he took up an appointment at Islington where he remained until retirement. Mr. J. N. Waite, controller, London Division, B.E.A., recently made a presentation to Mr. Dent on behalf of his colleagues at a luncheon arranged for this purpose.

Employees of **Chloride Batteries, Ltd.,** Clifton Junction, near Manchester, were responsible for the distribution of hundreds of dolls and toys to local children's homes as well as to children of sick employees. This distribution resulted from the company's third annual doll show and toy fair held at the end of December. The dolls and toys were purchased by the employees' Recreation Committee, assisted by a grant from the management of the company.

On 11th December eight hundred members and guests of **Johnson & Phillips, Ltd., Staff Association** held their annual dinner at the Lyceum. The occasion was marked by the celebration of the company's seventy-fifth anniversary. Following dinner, there was dancing and two cabarets. Among the guests were Lord Colgrain (chairman, Telegraph Construction & Maintenance Co.), Mr. G. L. Wates (chairman of J. & P.) and Mr. W. Glass (joint managing director, J. & P.)

OBITUARY

Mr. J. N. A. Houblon.—The death occurred on 20th December of Mr. John Newton Archer Houblon, M.I.E.E., a director of the Electric Supply Corporation (Overseas), Ltd. Mr. Houblon was a pupil with Crompton & Co., Chelmsford, in 1898, and for twelve years was in charge of the Contract Department of the company at head office. He was largely responsible for the design and construction of many early electric lighting undertakings for the Electric Supply Corporation, Ltd., and other companies in England and Scotland, and also some of the earlier installations in India, including Nagpur, Karachi, Lucknow, Allahabad, Ahmedabad, etc. At a later date the early development of the Sevenoaks and District Electricity Co., came under his supervision, followed by the

Jersey Electricity Co., Ltd., of which he became managing director. He was also a director of the Electric Supply Corporation, Ltd., and the Central Sussex Electricity Co., Ltd., until these companies were nationalized.

Mr. R. B. Mitchell.—The death occurred on 17th December, at the age of seventy-nine, of Mr. Robert Burgess Mitchell, M.I.E.E., who was chief engineer and manager of the Glasgow Corporation Electricity Department from 1920 until his resignation in 1928. Mr. Mitchell spent almost the whole of his career in Glasgow, commencing in 1893 as shift engineer in a battery station. Mr. Mitchell was president of the I.M.E.A. in 1925 and was a past chairman of the Scottish Centre of the Institution of Electrical Engineers. He was a member of the American Institute of Electrical Engineers and a former vice-president of the Institution of Engineers and Shipbuilders in Scotland.

Mr. G. B. Dent.—The death is reported of Mr. Gracchus Brown Dent, A.M.I.E.E., station engineer, Torquay and Newton Abbot, B.E.A. South Western Division, which occurred on 21st December at the age of sixty-four. Mr. Dent received his education at Leeds Technical College and his training with Flather & Co., subsequently holding positions with the Wakefield District Light Railway, J. Dickinson & Co. (at Apsley power station), the Northmet Co. and the Northampton Electric Light & Power Co., before going to Torquay as station engineer in 1919.

Mr. E. J. Ivison.—The death occurred on 23rd December at the age of eighty-two at Bognor Regis, of Mr. Edgar Joseph Ivison, M.I.E.E.

Mr. C. W. Clarke, A.C.I.S., whose death occurred on 14th December at the age of eighty-one, was assistant secretary to the former Callender's Cable & Construction Co., Ltd., and at the time of his retirement in 1940 had been with the company for forty-five years.

Mr. T. G. Russell.—The death occurred on 18th December of Mr. Thomas George Russell, LL.B. (Manchester), former vice-chairman of British Driver-Harris Co., Ltd. Mr. Russell, in the capacity of solicitor and legal adviser, was connected with the organization from its formation. He became secretary in 1931, a director in 1945, managing director in 1946 and vice-chairman in 1947. He retired from the vice-chairmanship of the company in September, 1948.

Mrs. J. A. Sumner.—The death occurred on 23rd December of Mrs. Rhoda Sumner, wife of Mr. J. A. Sumner, manager of the Norfolk Sub-Area, Eastern Electricity Board.

New Year Honours

AMONG those included in the New Year Honours List, which was published on Monday last, are a few members of the electrical and allied industries:—One of the Knights Bachelor is Mr. E. D. A. Herbert, O.B.E., M.I.Mech.E., M.I.E.E., chairman of Short Bros. and Harland, Ltd., Belfast; another is Mr. A. McC. MacTaggart, director of Balfour, Beattie & Co., Ltd., and president of the Federation of Civil Engineering Contractors.

The list of those who become C.B.E. includes Mr. D. W. Barrett, director and general manager, Smiths English Clocks, Ltd.; Mr. K. Baumann, M.I.Mech.E. (formerly with the Metropolitan-Vickers Electrical Co.), for services to turbine development; Mr. H. Constant, director, National Gas Turbine Establishment; Dr. Oscar Faber, O.B.E. (Oscar Faber & Partners), for services in the rebuilding of the House of Commons; and Mr. J. N. Waite, controller, London Division, British Electricity Authority.

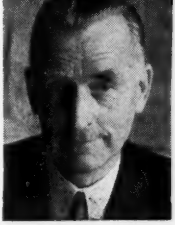
The following are appointed O.B.E.s:—Mr. R. Clarke, M.I.Mar.E., marine director, Laurence, Scott & Electromotors, Ltd.; Mr. B. Gardner, general secretary, Amalgamated Engineering Union; Mr. R. G. Kilburne, M.I.E.E.,

Mr. J. N. Waite (C.B.E.)

Mr. K. Baumann (C.B.E.)

Mr. W. J. Cooper (M.B.E.)

Mr. R. Lee (M.B.E.)



chief electrical engineer, Government of Nepal; Mr. F. Shakeshaft, A.M.I.E.E., generation design engineer, B.E.A.; and Mr H. S. Shipway, factory manager, Post Office Factories Dept., Birmingham.

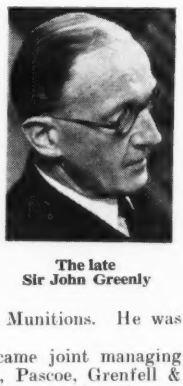
Included among the M.B.E.s are Mr. A. S. M. Borner, managing director, Clifford & Snell, Ltd.; Mr. W. J. Cooper, M.I.E.E., liaison officer, S.W. Scotland Electricity Board; Mr. E. G. S. Gregory, assistant engineer, London Telecommunications Region; Mr. Robert Lee, M.I.E.E., A.M.I.Mech.E., Sub-Area liaison officer, London Electricity Board; Mr. S. D. Pendry, A.M.I.E.E., engineer, Telephone Manager's Office, Guildford; Mr. L. Rushforth, M.I.E.E., head of section, B.T.H. Research Laboratory, Rugby; Mr. C. W. Skinner, assistant superintendent engineer, transmitters, B.B.C.; Mr. W. J. Sparey, manager, electrical dept., Silley, Cox & Co., Falmouth; Mrs. F. E. B. Timonen (Miss McDonald), personal assistant to the chairman, B.E.A.; and Mr. J. M. Walshe, A.M.I.E.E., works engineer, Belliss & Morcom, Ltd.

The British Empire Medal is awarded to Mr. A. F. T. Brider, boiler-house foreman, South Wales Division, British Electricity Authority; Mr. J. Cosh, chargehand, Radar Research and Development Establishment, Malvern; Mr. G. H. Cowley, conveyor attendant, Merseyside and N. Wales Division, B.E.A.; Mr. E. Graves, chargehand, Standard Telephones & Cables, Ltd.; Mr. H. A. Hunstone, chargehand electrician, Midlands Division, B.E.A.; Mr. F. N. Hunter, boiler-house fitter, Merseyside and N. Wales Division, B.E.A.; Mr. J. B. Inglis, foreman linesman, South Western Division, B.E.A.; Mr. E. G. Long, foreman, Aeronautical & General Instruments, Ltd.; Mr. H. Strickland, foreman electrician, Wm. Jessop & Sons, Ltd., Sheffield; Mr. W. C. Wilkinson, electrician, North Eastern Electricity Board; and Mr. J. Williams, jointer, South Eastern Electricity Board.

Mr. R. W. Haddon, C.B.E., who receives a knighthood, is chairman of the Ministry of Agriculture Publicity Advisory Committee, is chairman and managing director of Farmer and Stock-Breeder Publications, Ltd., and also deputy chairman of Associated Iliffe Press, Ltd.

Sir John Greenly

THE death on 31st December is announced of Sir John (Henry Maitland) Greenly, who was chairman of Babcock & Wilcox, Ltd., until July last when he retired from that position but remained on the board. Sir John Greenly was born at Titley, Herefordshire, in 1885. He was educated at Charterhouse and Trinity College, Oxford, and was trained as a civil engineer. He served in the Hertfordshire Regiment during the 1914-18 war attaining the rank of Lt.-Colonel. He also held a position in the Ministry of Munitions. He was made a C.B.E. in 1929.



The late Sir John Greenly

In 1920 Sir John became joint managing director of Wm. Foster, Pascoe, Grenfell & Co. and subsequently joint managing director of British Copper Manufacturers, Ltd. He joined the board of Babcock & Wilcox, Ltd., in 1929 and was elected deputy chairman in 1932 and chairman in 1937. He was made a K.C.M.G. in 1941 for his work as Controller-General of the British Supply Board in Canada and the United States in 1939-40.

Sir John was a director of a number of companies and had many wider interests, particularly in the fields of non-ferrous metals and fuel and power.

American Television Development

IN the November issue of the American journal *Electrical Merchandising* it is announced that the Capehart-Farnsworth Corp., Fort Wayne, Indiana, has developed a new television picture tube which will eliminate flicker and increase brilliance more than 5,000 times. Called the " memory tube, " it stores a complete picture and then releases it to the viewing screen 30 times a second, in place of the present method of continuous scanning by a pin point of light. The advantages claimed for this new tube are the elimination of scan lines which are the basic cause of eyestrain, increase in brilliance sufficient to permit theatre projection, the elimination of distortion on the face of the viewing screen and more clarity for colour pictures. The tube will not cause present television receivers to become obsolete; in fact little modification to existing sets will be necessary for its use. A paper on this development is to be read at a meeting of the Institute of Radio Engineers in a few months' time by Mr. Philo T. Farnsworth, but it unlikely that the tube will be in full production for at least two years.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Electric Boards' Test Reports

IT has always been of concern to us that upon completion of an installation a report on the test by the electricity supply authorities has invariably been sent to the customer direct. This often contains technical data regarding minor adjustments to meet the various regulations and is rarely of interest to anyone other than the contractor. The customer, however, usually assumes that something is drastically wrong and considers the contractor to be inferior. It is perhaps natural that even after making these modifications and getting the installation passed, some doubt remains as to the contractor's efficiency, with results that need no elaboration.

Recently we completed a contract which came under the Eastern Electricity Board's control, when we received an " Installation Test " letter with the following last paragraph:—

> " Should we hear from you within the next 14 days that you have completed the alterations suggested, it will not be necessary for us to notify the consumer of the results of our test and our recommended modifications."

Surely this is a method which might be favourably considered by other Boards. We feel that some mention of this in your columns would be in the interest of the trade.

London, N.W.1. S. E. QUITAK,
Director,
Modern Electric (Installations), Ltd.

Electrical Contracting

I WOULD like to refer to the article in the *Electrical Review* for 8th December by Mr. Taunton.

At this particular juncture I am not going to reply to the whole number of points and inferences which he makes in the article with regard to the attitude of operatives in the contracting industry, but just to draw attention to two inaccuracies with regard to the existing agreements between the Electrical Trades Union and the N.F.E.A.

On page 922 it is stated " When the lad has completed his apprenticeship—is ' out of his time '—it is customary to let him work for a clear year at mate's rate before taking up his tools as an electrician." Actually the position is that the young journeyman's role has been suspended indefinitely, and is recorded in decisions of the N.J.I.C. Standing Committee at a meeting held on 10th December, 1947.

On the same page it is stated " The working rules are now more or less standardized while basic rates of pay with an ' addition ' to cover the varying cost of living are revised from time to time." Here, again, it must be pointed out that as from the third pay-day in April, 1946, the " additions " have been stabilized at 3d per hour for labour under 18 years of age, 6d per hour for labour between 18 and 21, 9d per hour for labour 21 and over. The variable factor during this period has been the basic rate.

Hayes, Kent. R. G. MCLENNAN,
National Officer,
ELECTRICAL TRADES UNION.

Schoolboys' Exhibition

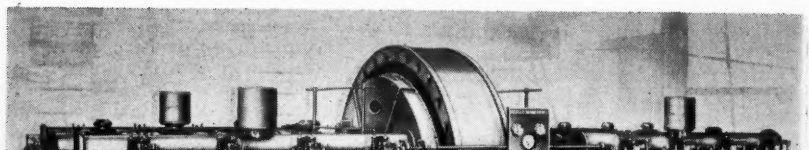
THE main centre of attraction at the Schoolboys' Own Exhibition now being held at the Horticultural Halls, Westminster, is the exhibit of the British Electrical Development Association. Surmounted by an illuminated " pylon," it has as its principal theme " What is Your Power Potential? " On entering the stand the boys pass a series of animated dioramas showing the production of energy—from the miner hewing coal to its final form as " units " of electricity.

After seeing the dioramas, which are situated in fairground surroundings under a model roundabout, the boys are invited to test their strength by striking a wooden block with a heavy mallet, the results being indicated in the kW equivalent on illuminated panels. Each boy is then given a card recording the figure, including details of what the same amount of electricity could accomplish in the domestic and commercial fields.

The use of electricity for soil heating is included in a comprehensive farming exhibit. The exhibition closes on Saturday, 13th January.

Manufacturers' Activities—II

Record G.E.C. Export Trade



Engine-driven 1,500 kW alternator in power house of Bremang Gold Dredging Co., Gold Coast Colony

FOR the second successive year shipments overseas by the General Electric Co., Ltd., exceeded the target, constituting a record both in value and volume.

Orders from the British Electricity Authority for 75 MW hydrogen cooled steam turbo-alternators brought the number of such machines now in hand up to nine. Home orders included a second 37·5 MW set for Huddersfield and two of the same rating for the Huncoat station at Accrington.

Mixed-pressure sets driving salient pole alternators were commissioned in the West Midlands Division of the National Coal Board. Turbo-generators were delivered overseas to Mount Isa Mines, Queensland, Samreaboi timber mill, West Africa, West Bokaro Mines, India, and the Electric Co. of Athens. Additional orders for hydro-electric plant for Pangani Falls, Tanganyika, will bring the ultimate capacity of this station up to 25,000 kW.

Engine-driven generators for the Bremang Gold Dredging Co., Gold Coast, exceed 8,000 kW capacity. The latest generator is centrally disposed between two sections of the engine and is specially constructed to permit inspection and maintenance of the stator without dismantling the engine.

A new design of outdoor breaker of 2,500 MVA capacity at 132 kV has been completed. The components are applicable for converting existing breakers to greater capacity. Total breaking time, from receipt of trip impulse to clearance of the fault, is less than 0·07 sec.

For the North Gujarat grid in India a new design of indoor triple-pole isolator has been developed for service where space is restricted. A recent contract in connection with extensions to this scheme covers equipment for six further substations. For the East Punjab (Nangal) power project, besides transformers and outdoor oil circuit breakers, the complete equipment for eight outdoor substations is being supplied.

At home, much switchgear work is in hand for grid extensions, as well as the provision of gear for the new 132 kV outdoor substations at Smethwick and Oldbury. Several boards built to the new "unit" design of sheet steel cubicles have been supplied to the B.E.A. Two, each of a total length of 150ft, are in hand for the Clydes Mill and Nechells stations.

A new range of surge divertors developed for rural distribution systems at from 2·2 kV to 33 kV normal are hermetically sealed for service under all conditions.

Of seven 45,000 kVA at 132/33 kV

nsformers in hand for the B.E.A., four re delivered during the year in addition two 41,000 kVA generator transformers r the Huncoat station. The first of six ,000 kVA generator transformers for kmouth is approaching completion.

A 1,500 kW twin-cylinder rectifier for w South Wales employs control grids for arc suppression, which is applied by electronic means. A repeat order for two mobile substations has been received from the Netherlands Railways. For the New Zealand Government Railways, eight 1,500 kW 1,600 V units have been built. The first three 630 kW British pumpless, air cooled, steel tank rectifiers in Belgium are now in commission on the Chemins de Fer Vicinaux. A 1,760 kW triple cylinder equipment is in service in the City of Edmonton, Canada; four 600 kW installations for Melbourne Tramways and a 500 kW grid controlled unit for New Delhi have been delivered.

At home, four 625 kW, 500 V rectifiers went to a chemical works for electrolytic duty and a further six are on order. A 660 kW, 440 V plant for electrolytic service has been delivered to Klipfontein Organic Products, South Africa, and three 870 kW, 200/250 V units for I.C.I., Yarraville, Australia.

The National Coal Board ordered two geared a.c. skip winders for Manvers Main, Shafts Nos. 1 and 2, the driving motors being of 1,500 h.p. and 2,250 h.p. respectively. The new horizontal liquid controller will be installed in each case. A double-drum winder has been put into commission at Nantgarw Colliery. For the Swansea area nine reversible slipring haulage motors aggregating 4,200 h.p. are on order, arranged for dynamic braking.

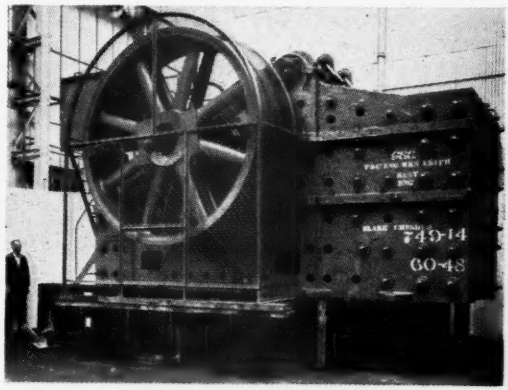
The first of four 4,200 h.p. a.c. winders for the State Development and Investment Corporation of South Africa is being erected on site. Each winder will be driven by two 2,100 h.p. 6·6 kV slipring motors, having a new form of dynamic braking.

A new design of hammer mill for sticky material which would plug an ordinary mill has been installed in Scotland to handle wet bauxite; a smaller machine is on order for difficult Northampton ore. A sectional 60in by 48in Blake crusher for New Broken Hill Consolidated, Ltd., of Australia, has been specially designed to go down a small mine shaft.

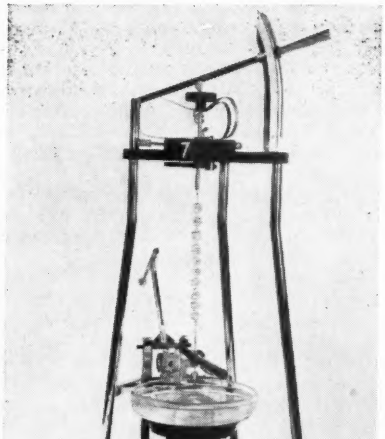
Coal preparation plant on order for Nantgarw Colliery, with a capacity of 350 tons an hour, will combine the Chance and froth flotation processes.

The rolling mill equipment for the 20in by 60in reversing mill for Austral Bronze Co. (Pty.) Ltd., Sydney, N.S.W., has been shipped. The motor is rated at 1,000 h.p., 565 V d.c. plus/minus 0/30/60 r.p.m. and is energized from an 850 kW Ward-Leonard Ilgner set. Other orders include complete electrical equipment for two strip mills at the Kynoch Works of I.C.I., each driven by 500 h.p. d.c. motors supplied from a 1,000 h.p. motor-generator set.

The New Port grain elevator, Buenos Aires, with a capacity of 150,000 tons, will be the largest in the southern hemisphere; electrical equipment is being supplied by G.E.C. The signalling control board, the largest of its type ever installed, shows the complete layout of the machinery in mimic diagram form in four basic colours. The board is of "Warerite" laminated sheet and is impervious to moisture, insects or fungi. It carries 258 relays, 201 special selector swithes, 151 push-buttons, 445 indicating lamps and 2,200 outgoing terminals. The back-of-board connections required nearly 25 miles of wire.



Sectional rock crusher for a mine of New Broken Hill Consolidated, Ltd., Australia



Production unit for diamond die piercing by electric arc

A new squirrel cage motor for driving textile carding engines, rated at 1·5 h.p., 960 r.p.m., is hinge-mounted so as to maintain belt tension. Starting torque is three times full load torque. A direct-to-line starter prevents tripping while starting, yet provides adequate overload protection. An isolating switch, integral with starter, has a reverse position for use when grinding the cards. A steady demand continues for loom motors. A recent order from Khaipur State textile mills, Western Pakistan, is for 500 motors of ¾ h.p. and 105 industrial motors and switchgear.

The electrical equipment for the forty 3,030 h.p., 3,000 V d.c. locomotives for the South African Railways is in course of manufacture. The first 505 h.p. traction motors are nearing completion.

Comprehensive schemes embodying load bias busbar protection are in service at Clydes Mill power station, Glasgow, the 33 kV substation at Castleton, Lancs, and in four 33 kV substations on the Liverpool Street to Shenfield line.

A biased differential two-pilot feeder protection scheme has been developed for use on distribution networks where only low ratio or existing low output current transformers are available for operating the relays. It is also applicable to "Teed" feeders. Improvements in the relay for biased differential protection of generators give more rapid operation, 50 milliseconds (2½ cycles on 50 c/s) which does not impair performance with respect to fault setting or stability. This system is being widely used for B.E.A. generating stations. For ring main or parallel feeder protection a directional or earth-fault relay has been developed.

In a new range of induction motors of ⅛ to ½ h.p. at 1,440 r.p.m., available as split-phase, capacitor start, or 3-phase, particular attention has been paid to ventilation, making possible a considerable reduction in size. An order from Canada for 11,000 of these machines is in hand.

A contract is in hand for the engine room equipment of a new passenger-cargo ship for the Booth Steamship Co., Ltd., covering main and auxiliary generators, auxiliary motors and a large amount of control gear. The single screw turbo-electric oil tanker, *San Salvador*, built by the Furness Shipbuilding Co., Ltd., for the Eagle Oil Shipping Co., Ltd., is in commission. She is a sister ship of the *San Silvestre*. The G.E.C. provided electric propulsion and auxiliary electrical equipment for both vessels. The electrical propulsion equipment of the *Sir Thomas Brocklebank*, a pilot boat for the Mersey Docks and Harbour Board, provides for very small increments of speed for keeping station.

An electronically controlled printing press drive is in service at the Amalgamated Press, Ltd. Repeat orders for such control equipment for motor drives have been received from Triplex (Northern), Ltd., and from the Triplex Safety Glass Co., Ltd. For the Head Wrightson Machine Co., Ltd., a contract is in hand for complete electronically controlled driving equipment for one 300,000 lb and three 100,000 lb drawbenches, one of which is for export. An electronic speed control drive for a veneer peeling lathe has been built for Dehra Dun, India, and two for the Tyne Plywood Co., Ltd.

In connection with lamp developments the use of an electric arc to pierce diamond dies for drawing tungsten filaments saves a great amount of time. Holes of 0·0002in diameter are made in this way.

Commerce and Industry

Token Import Scheme

B.E.A. Publicity Decision

THE Board of Trade announces that the token import scheme is to be continued in 1951 for the same countries and the same commodities as in 1950. The token import annual quota will, however, be increased from 20 to 40 per cent by value of each manufacturer's average annual trade in 1936-1938 with the United Kingdom in the commodity in question. In addition, it has been decided that in cases where a manufacturer in one country has ceased to make a commodity for which he is, or was, entitled to a quota under the scheme, his quota may be allocated to other manufacturers of that commodity in that country, whether or not they have been qualified to participate in the scheme hitherto. The countries participating in the scheme are:—Australia, Belgium and Luxembourg, Canada, Denmark, Finland, France, Holland, India, Italy, Norway, Pakistan, Sweden, Switzerland and the United States. In the list of commodities which may be imported under the scheme are industrial porcelain insulators; carbon electrodes; electric light bulbs; electric light fixtures; switches; dry batteries (torch and high tension); electricity meters; fans (complete with motors for domestic use); electrically-operated domestic washing machines; vacuum cleaners, and parts; electric refrigerators for domestic purposes, and parts; and electrical equipment for cycles and motor cycles.

Catering Equipment Exhibition

When it was learned that the British Federation of Hotel and Boarding-house Associations was holding its annual conference in the Winter Garden, Eastbourne, no time was lost by the East Sussex and South West Kent Sub-Area of the South Eastern Electricity Board in offering to stage an exhibition of modern catering equipment. With the co-operation of a number of manufacturers specializing in this type of apparatus a full range of the latest equipment was introduced on a stand in the conference hall. Delegates and members of the Federation from all parts of the country showed a keen interest. After the conference the exhibition was erected for two weeks in each of Sceboard's showrooms at Bexhill and Hastings and local hoteliers and caterers were invited to attend. The accompanying picture shows the stand as it appeared throughout this series of exhibitions.

A display of catering equipment by the East Sussex and South West Kent Sub-Area of the S.E. Electricity Board

Sulphuric Acid and Sulphur Restrictions

The Board of Trade announces that in consequence of the reduction in the export by the United States of sulphur to this country it will be necessary to restrict the consumption of sulphur in sulphuric acid plants operating on this material and for general industrial purposes. While the manufacture of sulphuric acid from raw materials other than sulphur will not be affected, the distribution of all acid produced will have to be controlled. The Board has therefore decided to institute a rationing system for the distribution of sulphuric acid and sulphur. Two Orders have been made which from 8th January prohibit, except under the authority of a licence granted by the Board, the supply of sulphuric acid and the supply of crude sulphur; sulphur which has been recovered by any industrial process; or of processed sulphur. The supply of processed sulphur in quantities not exceeding 56 lb in any one month is not

affected by these Orders. The Orders are the Control of Sulphuric Acid Order, 1950 (S.I. 1950 No. 2087, price 1d), and the Control of Sulphur Order, 1950 (S.I. 1950 No. 2084, price 1d), which are available at H.M. Stationery Office.

B.E.A. Advertising

Following adverse comments on its national advertising the British Electricity Authority has decided to suspend for about three months all forms of " promotional " advertising and the Electricity Boards have been requested to follow the same course. Instead, the Authority has adopted a form of advertisement which stresses the need to keep electric fires off the peak, giving the times when this is necessary. The advertisements will appear in the national Press and popular periodicals and in the form of posters for displaying in factories and commercial premises.

J. & P. and Telcon

To give cable users a better delivery service, and in particular to enable them to deal with urgent requirements with the minimum of delay, Johnson & Phillips, Ltd., and the Telegraph Construction & Maintenance Co., Ltd., announce that they have pooled their manufacturing resources for the production of stock quantities of mains cables to established C.M.A. standards. By combining existing stocks and establishing a joint programme for future stock production, the two companies offer collectively a more comprehensive range of cables than hitherto, and will hold the stock items in larger quantities. The works or the nearest branch office or representative of either company will deal with inquiries, and whilst to implement the arrangement each company may supply cable manufactured by the other, the company effecting the sale will accept full responsibility under its normal conditions of sale for the material supplied.

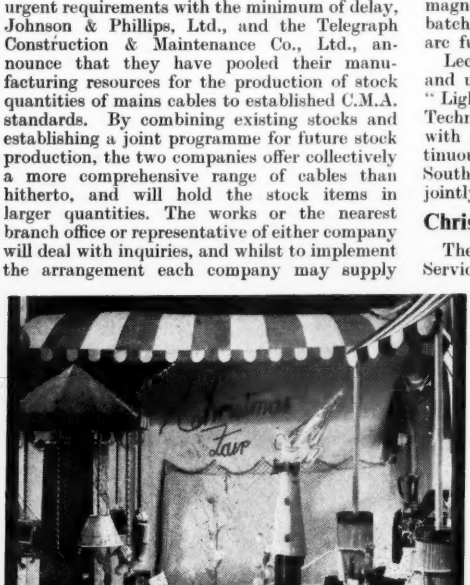
Glasgow Electrical Power Exhibition

An electrical power exhibition is being held at Glasgow's Engineering Centre from 21st December to 12th January to present a selection of exhibits illustrating recent developments connected with the generation and utilization of electrical energy. The exhibits themselves have been carefully chosen to interest a wide public—from purely technical to schoolboy level—and are arranged in the following sections:—Boilers and combustion; generation; transmission; various applications of electricity; and water cooling. A novel feature is the robot commentator, an electronic tape recording machine which voices information about the exhibits and leads the visitors from one section to the next. Prominent amongst the models are a 7ft high representation of Portobello power station, a wind power generator, and an induced draught cooling tower. Other exhibits on view are a magnetic recollectograph (the magnetic memory), an electronic counting and batching machine, an electrolytic polisher, an arc furnace and a recording surge volt meter.

Lectures are being given to senior schoolboys and university students including a lecture on " Lightning " by Professor Bruce of the Royal Technical College of Glasgow. Films dealing with electrical subjects are being shown continuously. The Engineering Centre and the South West Scotland Electricity Board have jointly organized the exhibition.

Christmas Window Displays

The Eastern Electricity Board ran a Christmas Service Centre display competition, the Centres being judged on the display arrangements both in the windows and in the showroom interior. The Service Centres were divided into two classes, large and small, the winners in the large class being Duke Street, Norwich and in the small class Hertford. The winning Service Centres in the six Sub-Areas were Hemel Hempstead (Chilterns), Halstead and Romford (Essex), who tied, St. Ives (Fens), Swaffham (Norfolk), Wood Green Northmet), and Southwold (Suffolk).



The Norwich Service Centre Christmas display which won the E.E.B. competition for large displays

Lancashire Dynamo & Crypto

The shareholders of Lancashire Dynamo & Crypto, Ltd., at a meeting held on 28th December approved a resolution changing the name of the company to Lancashire Dynamo Holdings, Ltd. Incorporated in 1899, Lancashire Dynamo & Crypto, Ltd., in addition to developing its own business, has acquired a number of subsidiary companies, including interests overseas. These undertakings now represent a considerable part of its activities and it is felt that, whilst changing the parent company to a holding company will not affect the financial position of the group, substantial administrative advantages will be achieved. To coincide with this change of name a new company has been incorporated and will be known as Lancashire Dynamo & Crypto (Mfg.), Ltd. This company will be a wholly owned subsidiary and will operate and ultimately acquire the manufacturing business at present operated as Lancashire Dynamo & Crypto, Ltd., with main factories at Trafford Park, Manchester and Willesden, London. The board of this new subsidiary will consist of Messrs. H. W. Bosworth, A.M.I.E.E. (chairman), D. C. Lorkin, F.C.I.S., and A. W. A. Dick-Cleland, M.I.E.E. (joint managing directors), F. F. H. Schroeder, A.M.I.E.E., and W. G. Swain. The directors have decided that the parent company (the directors of which remain unchanged) and the new subsidiary company will, as from 1st January, trade as a partnership in the name of Lancashire Dynamo & Crypto.

Swedish Electricity Regulations

With reference to the report on Sweden which was published in our issue of 8th December, we understand from the Board of Trade that it has no copies of the Swedish electricity regulations available. We are informed by the British Standards Institution, 28, Victoria Street, London, S.W.1, however, that it has copies of these regulations which can be either purchased, borrowed or consulted. The B.S.I. states that it also has copies of electricity regulations in force in other parts of the world.

Census of Production for 1951

The scope of the Census of Production to be taken in 1952 in respect of the year 1951 has now been settled. All establishments within the field of production, including those engaged in building and contracting, will be included in the Census. The statutory form of return will include questions on working proprietors; employment; wages and salaries, etc.; plant, machinery and vehicles; new building work; power equipment and fuel usage; shift-working; materials and fuel purchased; work given out; stocks at the beginning and end of the year; output, and transport payments.

Information about power equipment and fuel usage is to be collected for the first time since 1930 and will be of value in showing how far the use of power in industry has increased since that time and in making comparisons with other countries. In addition the results will be of special value for the study of productivity. Detailed lists of the output headings to be specified for 1951 have already been sent for comment to the trade associations concerned for nearly all trades. Any firm requiring further information should write to the Census of Production Office, Neville House, Page Street, London, S.W.1.

Census of Distribution

Forms for the first Census of Distribution have now been delivered to about 654,000 retailers, 101,000 wholesalers and others. The Census, which is compulsory and for which general returns are required for each separate establishment, covers all wholesale and retail distribution with some special exceptions, and certain selected service trades. The completed forms must be returned by 31st March except in the case of traders who wish to make a return for the business year ending between 31st December, 1950, and 6th April, 1951, when the three months from the end of the business year will be allowed, provided that notification has been sent to the Census Office. Any trader who thinks he is covered by the Census and has not received a form, should write to the Board of Trade, Census of Distribution Office, Jersey Road, Osterley, Middlesex.

Aluminium and Copper Prices

As from 1st January the price of virgin aluminium in ingots was raised from £120 to £124 a ton.

The Minister of Supply has also made further additions to the prices of special copper shapes and copper of special specifications.

Lighting at B.E.A. Headquarters

Last week we described the lighting installed in two main conference rooms at the headquarters of the British Electricity Authority in Oxford Street, London. It should have been mentioned that the installation was carried out by Duncan Watson (Electrical Engineers), Ltd.

Compensation Award

The salary scale which was negotiated by the Association of Municipal Electrical Engineers (now the Association of Managerial Electrical Executive) in 1941 was recognized by the National Arbitration Tribunal before the electricity supply industry was nationalized. This recognition was sustained in recent proceedings before the Ministry of Labour and National Service Compensation Appeals Tribunal.

Mr. R. C. Golding, formerly borough electrical engineer of Southend, appealed against the Eastern Electricity Board's refusal to pay him compensation for the loss sustained by him on account of the withdrawal of this salary scale. He

claimed that he was appointed by the Southend Corporation under the A.M.E.E. salary scale which provided for the payment based on the amount of energy sold annually. When the Electricity Board withdrew the scale as a method of remuneration he suffered a worsening of conditions of service.

The Tribunal awarded Mr. Golding an annual sum of about £114.

Housecraft Advisors

The inaugural meeting of the first branch of the Association of Electrical Housecraft Advisors was held in Manchester on 25th November. The new branch embraces the North-West and the Merseyside and North Wales area. Miss M. G. Gosse, chairman of the Association, attended and a message of goodwill was received from Dame Caroline Haslett, President of the Association. The chairman of the Branch is Miss M. D. Elkington, demonstrator for No. 1 Sub-Area, North Western Electricity Board. The guests included representatives from the North Western and Mersey and North Wales Electricity Boards and from local educational authorities.

Wages Award Protest

Last week the Manchester District Engineering Employers' Association condemned as "unconstitutional and indefensible" the action taken by employees of engineering concerns in the area (including the Metropolitan-Vickers Electrical Co.) in refusing to operate piece-work as a protest against the recent wages award. The Association denies that it is possible for the employees to claim that they are honouring the agreement which was freely entered into by the trade unions. There is a well-established procedure for dealing with complaints and the Association regrets that the men have not used it.

Trade Announcements

Stressed Concrete Design, Ltd., has moved to "Lynton House," 54 South Side, Clapham Common, S.W.4 (telephone: Macaulay 3331).

Kersons Manufacturing Co., Ltd., has appointed Mr. G. Johnson as agent for Birmingham. He will operate from 57, Keswick Road, Sheldon, Birmingham, 26 (telephone: Sheldon 2245).

A new branch is being opened by **Enfield Cables, Ltd.**, at 124 Broad Street, Hanley, Stoke-on-Trent (telephone: Hanley 1310). The branch manager will be Mr. J. J. Timmins, who has been a member of the Birmingham staff for many years.

The registered offices of **Marconi's Wireless Telegraph Co., Ltd.**, and the **Marconi International Marine Communication Co., Ltd.**, are now at Marconi House, Strand, London, W.C.2 (telephone: Temple Bar 1577). The main business of both companies will continue to be conducted at Chelmsford, but the Export Department of Marconi's Wireless Telegraph Co., and the Contracts Division of the Marine Co., will be housed in the Strand building. It was in this building that the Marconi Co., first made regular broadcasts from 2LO in 1922.

The power plant and machinery business of the **Lovat Engineering & Supply Co., Ltd.**, is now being carried on in the name of Dawson-Keith, Ltd., Hillview Works, Hillview Road, Sutton, Surrey (telephone: Fairlands 9174; telegrams: "Autogen, Sutton, Surrey").

Thorn Electrical Industries, Ltd., are now operating a depot at Craigton Industrial Estate, Barfillan Drive, Paisley Road West, Glasgow, S.W.2 (telephone: Glasgow-Half Way 4957).

Braithwaite & Co. Engineers, Ltd., have moved to Dorland House, 14/16, Regent Street, S.W.1 (Whitehall 3393).

Mr. J. B. G. Northcott, of Nottingham, East Midlands area representative of the **Electric Construction Co., Ltd.**, Wolverhampton, has been appointed to represent the company in Devon and Cornwall. His new address is "Lambourne," Penhallow, Truro (telephone: Perranporth 3227). His successor as East Midlands area representative is Mr. G. J. S. Drury, T.D., M.B.E., M.I.E.E., 22, Harley Road, Sheffield, 11 (telephone: Sheffield 70995).

Brush Export, Ltd., which was recently formed with its head office at Loughborough to handle all export business of the Brush Electrical Engineering Co., Ltd., has opened its own London office in Duke's Court, Duke Street St. James's, S.W.1, headquarters of the Brush/ABOE Group of Companies, and its manager is Mr. C. W. Glanister, M.I.E.E., who, until recently, was chief engineer and manager to the Ceylon Government Department of Electrical Undertakings.

A Disclaimer

Mr. L. Bloom, neon and electrical sign, reflector and fittings manufacturer, of 2, 3 and 4, Eden Street, London, N.W.1, asks us to state that he has no connection with L. Bloom of 56, Forburg Road, Stoke Newington, London, reference to whom was made in a bankruptcy notice in our issue of 15th December last.

Catalogues and Lists

Sloan Electrical Co., Ltd., 31-33, Broadway, Vauxhall, London, S.W.8.—Priced and illustrated catalogue of electrical accessories and wiring supplies.

Linolite, Ltd., 158, Bishopsgate, London, E.C.2.—Priced leaflet (No. 6) on "Linora" fluorescent reflectors and fittings for shop windows, show cases and general lighting.

OVERSEAS ELECTRICAL TRADE

Continued Improvement in Exports in November

AN increase of £275,564 over the October figure brought the total exports of electrical apparatus and machinery during November to within £79,790 of the record figure of £12,388,673 for August. The actual total, £12,308,883 was over £2¼ million above that for November last year, £1½ million of this increase being attributable to improved business in electrical goods and apparatus as distinct from machinery.

There was a considerable increase in the demand for enamel, glass or asbestos insulated and rubber insulated wires and cables, with a more or less corresponding decline in purchases of paper insulated types. Over twice as much sound reproducing apparatus was shipped as in November last year, while exports of all classes of radio apparatus and also valves were well maintained.

There was some falling off in sales of all classes of accumulators. Manufacturers of all types of domestic appliances report a good month, overseas sales of cooking appliances being doubled while the value of

TABLE I.—ELECTRICAL EXPORTS

Class	November, 1950	November, 1949
	£	£
Telegraph and telephone cables and wires (submarine)	52,400	117,625
Ditto, not submarine	608,173	628,782
Wires and cables, cotton, silk or artificial silk insulated	66,168	37,830
Ditto, enamel, glass or asbestos insulated	115,443	56,188
Ditto, paper insulated	423,757	623,258
Ditto, rubber insulated	426,548	270,222
Ditto, other	173,655	104,531
Commercial radio apparatus	680,149	203,465
Domestic radio apparatus	294,807	181,364
Telegraph, telephone and signalling apparatus	1,476,905	1,466,953
Radio loudspeakers	61,044	23,488
Sound reproducing apparatus, components, and parts other than cinematograph apparatus	501,409	238,595
Other sound reproducing apparatus	111,611	61,429
Radio valves	289,996	121,970
Electric lighting carbons	21,877	18,431
Lamps not exceeding 24 V	42,950	32,578
Discharge lamps	46,386	31,113
Other lamps	64,529	52,541
Other lighting apparatus	343,934	311,329
Primary batteries	147,985	112,898
Parts other than cartons	29,080	17,123
Accumulators for motor vehicles	172,726	176,428
Ditto traction	23,560	28,382
Ditto radio	2,211	3,321
Other portable accumulators	75,656	105,472
All other accumulators	17,077	50,281
Parts and accessories	81,126	89,412
Cooking appliances	151,641	73,837
Heating appliances	75,256	50,167
Parts and accessories for cooking and heating appliances	63,962	35,768
Flat irons	73,902	29,834
Commercial electrical instruments	143,004	101,902
House service meters	99,312	80,888
Time recorders and time switches	10,981	12,159
Other electrical instruments	120,426	112,584
Electro-medical apparatus (not X-ray)	57,904	39,465
X-ray apparatus, tubes and parts	74,492	38,256
Permanent magnets	28,237	22,282
Insulating cloth and tape	79,681	83,697
Other insulating materials	86,317	79,106
Unclassified electrical goods and apparatus	333,217	319,773
TOTAL electrical goods and apparatus	7,749,494	6,244,727
Generators, up to 200 kW	518,313	646,273
Ditto, over 200 kW	483,970	337,523
Ditto, parts	283,132	142,733
Motors, railway and tramway	10,541	15,785
Ditto, other, not over ½ h.p.	107,823	61,989
Ditto, over ½ h.p. but under 1 h.p.	43,963	25,047
Ditto, from 1 h.p. to 250 h.p.	452,233	396,672
Ditto, over 250 h.p.	74,890	31,952
Ditto, parts	103,615	69,065
Converting machinery	17,782	7,021
Transformers, including coils	691,554	588,349
Rectifiers for power house use	76,829	56,639
Motor starting and controlling gear	199,318	183,405
Switchgear and switchboards (not telegraph or telephone)	899,389	799,973
Other electrical machinery	98,629	36,697
TOTAL electrical machinery	4,061,981	3,399,123
Vacuum cleaners and parts	246,216	168,504
Other electrically operated portable appliances	130,643	153,159
Portable electric tools	120,549	98,659
GRAND TOTAL	12,308,883	10,064,172

flat irons exported showed an increase of one and a half times over the November, 1949, figure. Over 40 per cent more commercial electrical instruments were disposed of and there was a good market for electro-medical and X-ray apparatus. Taken as a whole, the largest purchaser of electrical goods and apparatus continued to be Australia which took £994,599 worth out of a total of £7,749,494; India (£651,691) and South Africa (£588,229) were the next best markets. Full details of distribution are given in Table II.

TABLE II.—Distribution of Electrical Goods and Apparatus

Destination	Nov., 1950	Nov., 1949
	£	£
Channel Islands	32,548	32,177
Malta and Gozo	9,900	74,754
Cyprus	11,558	17,459
British West Africa	108,797	77,547
Union of South Africa	588,229	539,477
Northern Rhodesia	16,667	31,702
Southern Rhodesia	80,081	158,784
British East Africa	153,108	119,610
Bahrein, Koweit, Qatar and Trucial Oman	20,847	23,600
India	651,691	520,449
Pakistan	186,596	154,762
Malaya	206,492	263,232
Ceylon	114,034	57,528
Hong Kong	126,571	120,887
Australia	994,599	1,051,530
New Zealand	474,983	307,228
Canada	350,401	105,031
British West Indies	73,122	98,962
Anglo-Egyptian Sudan	17,485	26,477
Other Commonwealth Countries	102,258	57,051
Irish Republic	309,255	210,176
Soviet Union	28,483	26,114
Finland	25,941	31,214
Sweden	258,097	112,261
Norway	172,225	146,499
Iceland	12,375	19,582
Denmark	156,110	100,549
Poland	51,090	112,699
Germany	38,138	12,833
Netherlands	267,478	129,928
Belgium	132,264	83,371
France	121,730	48,150
Switzerland	61,298	49,437
Portugal	138,947	19,145
Spain	34,112	20,321
Italy	81,758	31,571
Austria	74,913	52,778
Hungary	3,577	12,850
Czechoslovakia	9,326	22,432
Greece	44,280	76,514
Turkey	20,110	84,966
Indonesia*	9,398	44,182
Netherlands Antilles	3,412	2,706
Portuguese East Africa	12,249	14,553
Syria	17,090	7,855
Lebanon	17,134	25,182
Israel	45,414	33,873
Egypt	246,951	123,866
Arabia	1,581	13,673
Iraq	135,782	65,346
Iran	101,710	152,207
Burma	18,206	36,916
Thailand	22,302	27,227
China	20,262	2,128
United States of America	142,531	19,038
Mexico	691	7,446
Colombia	17,140	10,728
Venezuela	27,047	29,633
Chile	15,532	11,442
Brazil	202,117	30,448
Uruguay	17,813	10,421
Argentine Republic	102,109	247,795
Other Foreign Countries	910,349	80,365
Total	7,749,494	6,244,727

* Includes Netherlands New Guinea in 1949

Although Russia remained the largest buyer of generators, taking £191,339 worth out of £1,285,415, the figure was much below the previous month's purchases (£662,545) and was not greatly above the next most important customers—South Africa (£164,612) and Australia (£161,269). Of the total of £1,983,501 worth of transformers, convertors, rectifiers and switchgear, India took £368,325, South Africa £333,988 and Australia £259,267; the last two countries were also the biggest buyers of motors, taking £141,584 and £111,430 worth respectively.

Imports of electrical goods and apparatus totalled £455,878, compared with £313,405 in November, 1949, and included £118,525 worth of valves and £40,275 of electrical instruments. Holland furnished the largest proportion (£195,212) with the United States (£80,725) as the next largest supplier. Electrical machinery imported included generators (£41,725) and motors (£25,408).

Flameproof Apparatus

AMONG the recent publications of the British Electrical and Allied Industries Research Association (E.R.A.) is a report Ref. G/T244, "Flameproof Electrical Apparatus. Flange Gap Protection and Container Pressure with a Fourth Series of Industrial Atmospheres," which has been compiled by A. P. Paton.

Summarized results of the E.R.A.'s researches on flange gap protection for air filled flameproof electrical apparatus have already been published in Refs. G/T139, G/T167 and G/T183. These reports give data for thirty-one gases and vapours commonly met with in industry. Particulars for eight other gases contained in the present report complete the results arising from these researches, though similar work on the question of flanged protection for oil immersed gear continues and other work such as the study of the basic principles of intrinsic safety is being pursued.

The main results given in the present report have been communicated to the British Standards Institution for use in connection with the revision and amendment of B.S.229. Copies of this publication are available from the E.R.A. at Thorncroft Manor, Dorking Road, Leatherhead, Surrey, price 7s 6d, postage 3d.

Technological Education

Proposed New Royal College

By A. L. JOHNSON, M.A.(Cantab.)

FEW people engaged in industry have very much knowledge of the recent publication by the Ministry of Education of a White Paper entitled " The Future Development of Higher Technological Education,"* which is the report of the National Advisory Council on Education for Industry and Commerce. This body is generally known as the Weeks Committee, from the name of its chairman, Lt.-Gen. Sir Ronald M. Weeks.

Little Publicity

The report has received remarkably little publicity in the Press, apart from a leading article in *The Times* and a letter two days later from Sir Frederick Handley Page, but it is of considerable interest and importance to all those who are in any way responsible for carrying on industry, particularly to those who have to arrange the agenda for trade associations' periodic meetings.

In the foreword to the document the Minister of Education expressed the hope that the report would be widely studied before any decision was taken. He would welcome and consider any comments that might be made to him. This intention was reinforced by an answer to a question in the House of Commons. Commander Maitland asked the Minister of Education whether he would take specific action to invite comment from trade associations and other organizations interested in the report. Mr. Tomlinson replied that in issuing the report he particularly invited interested parties to send him any comments they desired to make. He very much hoped that they would do so, but he did not consider that any more specific invitation was necessary.

The list in Appendix A of organizations consulted in the preparation of the report does not include the names of any trade associations, though the Federation of British Industries and the British Employers' Confederation are mentioned, as well as nearly every nationalized industry. Many of the learned and professional societies and institutions submitted observations and are proposing to do so again in response to the Minister's request.

Some people have been under the impression that the Minister would wish to reach an early conclusion, but it is clear from his reply in the House of Commons that he will allow reasonable time for trade associations to make such observations as may seem good to them. Added thereto a letter from Sir John Maud, Permanent Secretary to the Board of Education, to me on 7th December makes it clear that it is now for the associations and bodies concerned to let him have their views on the report.

Committee's Recommendations

The recommendations of the Weeks Committee are really three in number:—(1) The development of new courses in advanced technology in the technical colleges, in close association with industry, and with the co-operation of the Regional Academic Boards. (2) Consideration by the Minister of Education of the possibility of increased financial aid to the authorities and a more generous allocation of building permits. (3) The establishment of a national body with the title " Royal College of Technologists."

The suggested Royal College should (*a*) approve suitable courses in advanced technology submitted by technical colleges under conditions appropriate to first and higher awards and (*b*) approve the appointment of suitable external examiners to assist the colleges in setting and marking their own examinations. The Committee also makes proposals for governing the Royal College which would consist, for a very long time to come, of nominees of the

*H.M. Stationery Office, price 1s; see also *Electrical Review*, 17th November, 1950, p. 790.

Crown in a large majority, which would mean, in effect, persons selected by the Ministry of Education. Finally, the Committee recommends that three awards shall be made: a first award or associateship, membership for a second, and fellowships or honorary fellowships for the highest.

With regard to finance, the proposals in Section 34 of the report seem a little anomalous. The present dual responsibility of the Ministry and local education authorities is to be retained, but further discussion on the most appropriate method of finance should be undertaken between the Ministry of Education and the local authorities. The suggestion of a Technology Grants Committee, on the lines of the University Grants Committee, is rejected on the rather curious grounds that " it is extremely difficult to separate provision for the needs of the technologist from other types of need in the field of technical education, until development has reached the stage at which colleges making advanced provision are free to concentrate on this work."

Conditions in Technical Colleges

Everyone will agree that it is vital that technical colleges shall improve their accommodation, plant, equipment and, especially, the conditions of service of those who teach in them in order to attract staffs of a suitable high quality. These needs are urgent and should be accomplished regardless of the question whether new qualifications, such as the Royal College is to offer, are really wanted.

All employers are anxious to find suitable persons with high qualifications in science and technology, but surely the first and most important question is to up-grade suitable technical colleges to a substantially higher standard and attract a specially high quality of men to act as teachers in them, before setting up a new body to grant qualifications.

Such up-grading will undoubtedly take time and very substantial sums of money, not only as to capital expenditure and running costs, but also for salaries, if the right men are to be obtained. It seems, therefore, that it is desirable not to reject out of hand the suggestion of a Technological Grants Committee for technical colleges, but rather to direct the discussions between the Ministry and the local authorities to the best way in which such a Committee should be set up and which technical colleges should be selected for up-grading, with an open mind as to whether certain of them should not be linked together into one or more technical universities.

The present University Grants Committee has undoubtedly assisted in the very great advances that have taken place in the work of the universities for many years, by establishing a mutual confidence and understanding between itself and the universities. For this reason, a similar Technological Grants Committee should be able to create a mutual confidence and understanding between itself and the technical colleges so as to develop courses of a suitable high level and, as matters progress, favourably to consider the establishment of one or more technical universities of degree-granting status.

It behoves all employers carefully to consider this report of the National Advisory Council on Education for Industry and Commerce and make such representations as they think fit to the Minister of Education, through their appropriate trade associations.

Many individual employers themselves possess either university or other similar qualifications, or are members of professional institutions or societies. It is to be hoped that they, especially, will study this report and urge their fellow members to join in these representations. The matter is believed to be somewhat urgent and failure by industry to make its views known may easily result in conclusions which may prove to be undesirable in the future.

Electroluminescence

WHEN certain materials are placed in a fluctuating electric field under suitable conditions, they are excited to luminescence and continue to emit light so long as the exciting field is maintained. This phenomenon of " electroluminescence " constitutes a new approach to the problem of " cold light " and in the November issue of *Illuminating Engineering*, the journal of the American Illuminating Engineering Society, it is discussed in some detail by E. C. Payne, E. L. Mager and C. W. Jerome (all of Sylvania Electric Products, Inc.).

It has been found that the light emitted under these conditions is in phase with and proportional to the wattage dissipated by the luminescent dielectric ; it varies with the applied voltage and with the frequency. The authors describe several practical applications such as luminescent clock faces and switch plates.

Zinc and Copper Restrictions

Electrical Appliances and Fittings Among Prohibited Uses

THE shortage of supplies of all grades of zinc likely to be available to industry in 1951 has necessitated the prohibition of its use for certain specified purposes, and at a Press conference last week Mr. Strauss, Minister of Supply, announced that in January a Statutory Order would be introduced prohibiting the use of zinc and brass for many purposes from 1st February. There would be provision in this Order for licensed exemptions for special purposes. To prevent substitution of copper in these uses, and to conserve the supplies of this metal, the Order would include prohibition of certain uses of copper.

The acute shortage of zinc at present was a direct result of the Korean situation. Since the Korean situation had developed there had been stock-piling of zinc by industries in every part of the world and by the United States Government. Britain imported two-thirds of its zinc from Australia, Canada and Norway and the other third from America and the Continent. There had been no reduction in the supplies from Australia, the chief cuts coming from the United States and Belgium. It was expected that imports would be down by about one-third and the total cuts now being imposed amounted to about 40 per cent of previous use.

During the first quarter of this year, the position was likely to be particularly serious and the supply of the ordinary grade of zinc might have to be restricted during that quarter to about 50 per cent of the rate of consumption during the first nine months of 1950.

Zinc Allocation System

An allocation system for zinc was to be introduced and would be made on a monthly basis. The February allocation would be determined in the latter part of January in the light of experience of the working of the January allocations and of any further developments in the supply position. Purchasers of zinc from the Ministry were being individually notified by the Directorate of Non-Ferrous Metals of their allocations for January. The quantities of the three grades of zinc available for distribution in this way were the following percentages of the average monthly rate of consumption over the first nine months of 1950:—Ordinary (G.O.B.), 50 per cent; electrolytic, used mainly in brass, rolled zinc products and zinc oxide—for brass 85 per cent, for other uses 70 per cent; high purity zinc, used mainly in die casting, 85 per cent. Mr. Strauss said that there were no plans at the moment for allocation schemes for other non-ferrous metals.

Provisional List

The provisional list of prohibited uses of zinc, copper and/or copper alloys is classified under fifteen headings. Under electrical and gas accessories and appliances are included the following:—Bodies and lids of electric kettles, saucepans, coffee percolators, waffle plates, and similar cooking and portable water-heating appliances; conduit tubing; fan blades and guards; lamp caps of certain types and sizes; lighting reflectors, shades, galleries and shade carriers, and suspension chains; conduit bushes and fittings for civil use; ornamental lighting fittings of all types, including table and standard lamps; reflectors, guards, and ornamental parts of electric radiators and bowl fires; switch, socket and bell-push plates; tumbler switch covers; wiring clips and non-current-carrying parts of wiring fittings and accessories; junction box covers.

Under general galvanizing are included tubes and fittings other than water tubes and conduit and conduit fittings. Exceptions from the list of fully galvanized iron and steel wire are electric cables for submarine and subfluvial cables, mining cables and certain Admiralty patterns; cables for coal mines, and cables where the armouring is left bare and bright. In the list of wiped galvanized wire the exceptions include telephone, telegraph line and earth wires; and electric cable.

ELECTRICAL MATERIALS

Production, Consumption and Prices in 1950

In this article the Metal Information Bureau, Ltd., again reviews the course of events during the past year which have influenced the markets for some of the principal raw materials used by electrical manufacturers.

COPPER.—The past year has witnessed some varying developments in copper with the result that the market has been rather unsettled, although in general the tendency has been for a steady upward movement in prices—from £153 a ton for electrolytic at the beginning of the year to £202 at the close. The Ministry of Supply continued its policy of aligning its selling prices to consumers in this country with values ruling in America, a policy which has at times come in for criticism owing to the almost unbroken firmness of the market there.

United States stocks were reduced steadily throughout the year as a result of the strong industrial call for copper and that country, once a substantial exporter, continued to take considerable supplies of foreign metal in order to supplement an inadequate domestic output; coupled with this were the steady acquisition of supplies by the strategic stockpile, and labour troubles at producing properties and mines.

For the greater part of the year consumers in Britain were not unduly affected as regards raw copper supplies and with good stocks held in the country the overall supply position was fairly bright; indeed, the concern of fabricators was not so much whether they could obtain supplies of copper in sufficient quantity as how to broaden the sale of their products. Doubts were entertained in many quarters as to whether industry in this country would be able to absorb the 330,000 tons of virgin copper envisaged by the Economic Survey for 1950.

However, the steady deterioration in the world political situation and the hostilities in Korea rapidly brought about a change in the copper position, not only here but internationally as well, and as consumers began to view with concern future supply prospects so demand was stepped up. Sentiment can be gauged by the substantial call for secondary metal and the high prices which were asked, and paid, for this material. It is significant that not only secondary but scrap copper prices also rose substantially above that of electro ingot. By the end of the year the supply position had become such that the Ministry of Supply announced that as from 1st January, 1951, until further notice, supplies of imported virgin copper to consumers would be restricted to a total each month equal to their average monthly consumption in the first half of 1950.

The Ministry of Supply's official maximum price for electrolytic copper changed as follows during 1950:—As at 1st January £153 a ton; 19th April £162; 18th May £164; 19th May £170; 6th June £186; 22nd August £202; 24th August £186; 1st September £202.

OUTPUT OF MAIN COPPER AND ALLOY PRODUCTS IN THE U.K. (Long tons)

Products	Copper content of output 10 months ended	
	31st Oct., 1949	31st Oct., 1950
UNALLOYED COPPER:—		
High conductivity products	181,212	165,761
Rods, bars and sections	4,621	4,597
Sheet, strip and plate	34,175	39,098
Tubes	31,940	33,041
Castings and miscellaneous	5,900	5,000
ALLOYED COPPER:—		
Wire	9,413	9,974
Rods, bars and sections	52,155	66,321
Sheet, strip and plate	47,371	51,297
Tubes	9,556	9,815
Castings and miscellaneous	29,841	29,571
Copper sulphate	8,946	11,395
TOTAL ALL PRODUCTS	414,230	425,870
Of which :		
Consumption of virgin copper	265,752	268,435
Consumption of copper and alloy scrap (copper content)	148,478	157,435

(Source : British Bureau of Non-Ferrous Metal Statistics.)

TIN.—The first full year of trading in tin on the London Metal Exchange following its reopening in November, 1949, cannot be said to have been uneventful. This was not surprising, however, since the function of a terminal market is to reflect world supply and demand, which in turn are moulded in large measure by world events—and tin has been amply affected by day-to-day developments.

The opening months of the year witnessed rather cautious trading with consumers loth to enter into any appreciable contracts whilst a wide (as it appeared to be at that time) backwardation existed between cash and forward tin. The Ministry of Supply still had some substantial stocks to dispose of and the method of this disposal was a constant source of concern to market operators; the Ministry on the other hand gave no indication of a desire to sell holdings at below £600 a ton, whilst remaining the virtual sole seller of cash metal. The entry of American buyers in Singapore and London, both for industrial requirements and for official stockpiling purposes, resulted in an improved market around mid-year and a rapid reduction in Ministry stocks was witnessed—later followed by a complete cessation of Government sales.

The outbreak of hostilities in Korea and French reversals in Indo-China aroused fears for the future of the tin mining and smelting industry in the Far East, including Malaya, and prices rocketed as a result, at one time touching the record figure of £1,300 a ton. Consumers all over the world bought strongly, Russia also trying to obtain supplies through intermediaries. An outstanding item of interest during the year was the failure of an international tin conference, held in Geneva, to arrive at a satisfactory solution of the long-term problem of balancing output and consumption without creating a top-heavy market.

LEAD.—The past year has proved a rather unspectacular one as far as lead has been concerned, and although prices have shown an increase on the year this has resulted more from a policy of following American quotations rather than from any factor relating to the supply of the metal itself. Most consumers in Britain have been able to obtain pretty well all the lead they needed and this has kept buying on a rather hand-to-mouth basis. Continental metal has been freely on offer, usually at prices well below what U.K. consumers have had to pay the Ministry of Supply, and the demand for dollar material has declined as a result.

Lead products for a good part of the year enjoyed only a moderate demand owing to high prices, such items as sheet and pipe being affected by the cut in capital expenditure on building. In general an aggressive sales policy had to be employed by fabricators. The trend can be gauged by a decision to reduce lead production in Mexico and the cessation of Ministry of Supply allocation to consumers in Britain. The market was undoubtedly bolstered by the strength of the other main non-ferrous metals and U.S. stockpile acquisitions and there was at various times a strong call for the recommencement of dealings in lead on the London Metal Exchange. Following the outbreak of hostilities in Korea a firmer tone developed but the comparatively unstrategic importance of lead found little material change being made in the situation.

U.K. consumption during the first ten months of 1950 amounted to 270,214 tons, compared with 272,067 tons during the same period of 1949.

Official maximum prices of pig lead fluctuated during the year as follows:—As at 1st January, 1950, £97 a ton; 10th March £88; 16th March £84; 21st April £86; 27th April £88; 5th May £90; 11th May £92; 12th May £96; 24th June £92; 29th June £88; 13th July £92; 14th July £96; 16th August £104; 22nd August £112; 2nd September £120; 9th September £128; 1st November £136.

ZINC.—During the first few months of 1950 the situation in zinc, in the United Kingdom at any rate, did not call for any special comment. Only a moderate consuming demand was in evidence and users on the whole found little or no difficulty in covering their requirements. A substantial part of the country's virgin zinc continued to come from dollar sources although the Government and Treasury were known to be keeping an eye on dollar spending in this connection. The basic position in zinc began noticeably to change a little before mid-year; in America, whose price changes Britain followed closely throughout 1950, industrial demand for zinc was growing steadily whilst at the

same time the stockpile was taking substantial regular tonnages. As a result, exports from that country were held down to a negligible figure although few countries without E.C.A. purchase authorizations were in a position to expend dollars on zinc. In Britain, the brass makers, galvanizers and die-casters experienced an increased call for their products and as the supply of raw zinc became more and more difficult prices of scrap and secondary metal soared—over £50 a ton more than the virgin quotation being paid without anything spectacular in the way of extra supplies being brought out.

By the end of the year the rearmament programme had not got into its stride but little real surprise was occasioned by the announcement first that zinc consumption was to be restricted somewhat and later that the Ministry of Supply was considering the institution of an allocation system. It was estimated that consumption during the first quarter of 1951 might have to be cut to about 50 per cent of the rate ruling during the first nine months of 1950.

The following changes took place in the Ministry's official selling price during the year:—As at 1st January £87 10s a ton; 25th January £85 10s; 15th March £87 10s; 28th March £89 10s; 4th April £91 10s; 20th April £95 10s; 2nd May £97 10s; 5th May £99 10s; 10th May £103 10s; 25th May £107 10s; 30th May £111 10s; 4th June £123 10s; 13th June £127 10s; 8th September £147 10s; 1st October £151.

ALUMINIUM.—The year opened with a good demand being recorded for most aluminium and aluminium alloy fabricated products and it is true to say that the majority of consumers were able fairly adequately to cover their needs. The bulk of this country's requirements of virgin metal continued to come from Canada and was being sold to users by the Ministry of Supply, the sole seller, at £112 a ton—a figure which compared favourably with prices ruling elsewhere in the world, including the United States.

The 1950 contract between the British Government and the Canadian producer resulted in this country purchasing 90,000 metric tons of virgin aluminium which, with 40,000 tons outstanding under the previous contract, meant a total supply of 136,000 tons during the year and would, in normal times, have provided the bulk of the country's needs. The situation in Korea and poor international political position, however, giving rise as they did to increased armament production, led to a very strong demand for aluminium and its alloys, aggravated by the high prices being quoted for other important base metals, so that towards the end of the year fabricated items such as sheet, strip and sections became extremely difficult to obtain, whilst scrap and secondary were also in very short supply.

The revaluation of the Canadian dollar resulted in the U.K. virgin aluminium price being raised to £120 a ton on 9th October, but even so it compared well with foreign quotations. During 1951 the U.K. will receive 200,000 metric tons from Canada and will have first claim on 220,000 tons during each of the years 1952 and 1953.

IRON AND STEEL.—The year opened with the British iron and steel industry operating actively and with a good demand recorded from both home and foreign consumers. However, as European plants began to get more into their stride offerings from that quarter increased. In the main United Kingdom steel products remained competitive and plants were kept busily engaged meeting home and export orders. Output of pig-iron gradually showed some improvement as the year progressed but production was never more than barely sufficient for consumers' requirements: semi-finished steel on the other hand remained in difficult supply and imports from Belgium and France had to be made to meet the needs of re-rollers. For a good part of the year the industry operated under the threat of nationalization but this made no difference to the pushing ahead with development plans laid by some major concerns.

The Economic Survey for 1950 put the steel ingot " target " for the year at $15\frac{3}{4}$–16 million tons and there seems little doubt that the upper figure will be achieved, particularly since rearmament plans have resulted in the installation of additional equipment. Various price increases were recorded during the year but British quotations have nevertheless remained competitive with other world producers.

RUBBER.—From a strategic point of view an item as important as rubber was bound to be substantially affected by world

developments during the past year and these are reflected in the steady rise in prices which have taken place. Broadly, rubber has risen from around 1s 2d per lb to 6s per lb. The main factor in the market has, of course, been the steady deterioration in the world political situation coupled with events in the Far East, so that despite stepped-up production, both of natural and synthetic rubber, consumers found it advisable to make purchases for stocking purposes and rubber became increasingly difficult to obtain. The American Government continued during the year to make purchases for the stockpile whilst European countries and Russia were also strongly in the market.

Total United Kingdom consumption during the second quarter of 1950 amounted to 22,659 tons, compared with 23,577 tons in the first quarter. Consumption during the whole of last year totalled 80,090 tons. Only a small part of this country's rubber absorption is in the form of synthetic. U.K. stocks of natural rubber at the end of September were just over 40,000 tons.

ELECTRICITY SUPPLY

Yorkshire Board's Decisions

Rural Electrification Schemes

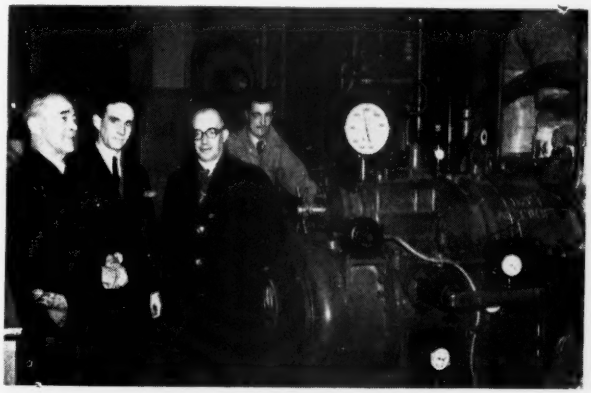
THE Yorkshire Electricity Board has decided to withdraw electric radiators from sale at all its service centres; to accept applications for combined cooker and water-heater installations only if a change-over switch is provided; and to ask the appropriate Government Department to consider securing a minimum of 20 per cent reduction in the industrial demand by load spreading.

Consideration for Farmers

Mr. G. A. Robertson, manager of the No. 4 Sub-Area, North Western Electricity Board, told a conference at Preston that although it was impossible to prevent electricity cuts to farms, the Board was doing everything possible to avoid interference with dairy and poultry farming. In the case of farms using supply for poultry incubation and brooding, the Board was either avoiding making cuts or reducing the period of the cut-off, whenever possible, to about 30 minutes.

Somerset Rural Schemes

At a Press conference on 22nd December Mr. H. G. Blay, clerk to the Bridgwater R.D.C., stated that a comprehensive electricity scheme for Bawdrip was to be begun that month and the scheme for Chedzoy was included in the estimate for the current financial year. The extension for Lyng was now being carried out. Extensions for Middlezoy and Othery were



Starting up a 52,000 kW, 3,000 r.p.m. Metrovick turbo-generator set at the new Agecroft power station of the B.E.A. North Western Division on 18th December. Left to right: Mr. P. Ridings, generation engineer (operation), No. 2 Sub-Division; Mr. H. Greenwood, power station superintendent, Agecroft; and Mr. J. L. Ashworth, generation engineer (operation), North Western Division

being submitted for approval and the extension to Stawell was scheduled to be carried out next year. Investigations were being made to see if schemes could be included in next year's estimate for Over Stowey and Spaxton but there was no immediate prospect of supply to Chilton Trinity, Fiddington or Otterhampton.

Scottish Rural Supply

Electricity reached the rural village of Spean Bridge, nine miles from Fort William, recently, when a new substation was opened there by the North of Scotland Hydro-Electric Board. The Rev. Dr. Alex M'Kinnon, a county councillor, performed the ceremony. An exhibition of modern electrical appliances provided by the Board was visited by the people of the village after the switching on.

Quebec 200,000 h.p. Project

A substantial addition to the power resources of the Province of Quebec has recently been announced by the Aluminium Company of Canada, Ltd. According to a statement from the company, work will start immediately upon the construction of a 200,000 h.p. generating station at Chute du Diable on the Peribonka River, the principal waterway of the Lake St. John watershed. The dam and power house represent a major construction job as over 450,000 cu yd of rock must be excavated, and some 275,000 cu yd of concrete will be required for the completed project. Plans call for the entire job to be finished within a two-year period.

House Installations

The borough engineer of Wallsend (Mr. G. N. Teasdale) has submitted an estimate of £2,882 for the installation of electric lighting in houses at present served by gas. The Council is applying for a loan to cover the cost.

London Tramway Conversion

Stage II of the scheme for converting South London's tram routes to bus operation comes into effect this week-end. It consists of the replacement of nine tram routes and will see the end of all tram services in Wimbledon, Merton, Colliers Wood, Tooting and Balham, a reduction in the routes serving Streatham and Brixton and a further reduction in those in Lambeth, Southwark, Wandsworth and Westminster. It will also increase the number of bus routes along the Victoria Embankment to six. Under Stage II of the conversion 101 trams will be withdrawn and 117 buses introduced making altogether (Stages I and II) 188 trams withdrawn and 240 buses introduced. The total miles of single tram track abandoned in the two stages will be 39½, leaving 162½ miles still in use.

Machines and Power Networks

THE coming term's post-graduate course in electrical machines and power at Imperial College, South Kensington, has as its main feature two series of fifteen afternoon lectures by Dr. J. R. Mortlock and Mr. B. Adkins of the British Thomson-Houston Co., Ltd. Dr. Mortlock's lectures commence on Monday, 15th January, and will deal with some transient problems in electrical power networks; they are an extension of the series delivered last winter. The lectures by Mr. Adkins commence on Thursday, 11th January; he will present a new approach to the general theory for the analysis of the performance of electrical machines.

An allied course of 10 lectures dealing with the Science of Nuclear Power is to be presented by Dr. O. Buneman, Mr. J. Diamond and Mr. R. V. Moore of the Atomic Energy Research Establishment, on Friday afternoons at 4 p.m., commencing on 12th January.

A limited number of qualified external persons can be accommodated at these lectures following prior application and acceptance. Further particulars and forms of application may be obtained from the Deputy Registrar, City and Guilds College, Exhibition Road, London, S.W.7.

American 150 MW Set

THE formal placing into service in mid-December of the first 150 MW steam turbo-generating set in the new Ridgeland station of the Commonwealth Edison Co. put Chicago's power pool in a comfortable position. The station is the first all-new one to be constructed by the company since 1929. It has taken three years to build. A second machine is scheduled for completion in the summer of 1951 and a third in 1953, constituting three-fourths of this station's ultimate 600 MW capacity.

This generating plant is the largest single project in the company's post-war constructional programme and the first machine raises the system capacity to 2,800 MW. It occupies a 96 acre site on the Illinois waterway in the south-west of the city and it increases the number of stations in the Edison group to eleven, all of which are interconnected. Since the war the company has installed more than 500 MW of generating plant; the construction of more than 400 MW of additional capacity during the next four years has already been authorized and it now has under consideration the installation of 250 MW more.

The Ridgeland station will consume coal at the rate of 1,500 tons a day, which will raise the Edison group's consumption to 9,000,000 tons yearly, or about one-sixth of the output of the Illinois State mines.

Area Activities

Electricity Boards' Reports for 1949-50

NORTH EASTERN

AMONG new industrial premises supplied by the North Eastern Board during 1949–50 were three large factories manufacturing electric cables, furniture and tobacco products, with an aggregate plant capacity of 14,000 kW. Altogether, arrangements were made for new and increased industrial supplies totalling 31,723 kW of installed load, in addition to which 31,000 kW of consumers' plant was connected.

Supplies were provided to 25,542 domestic premises, including 13,961 new houses; it is noted that the time lag between the completion of houses and the connection of the supply has now been practically eliminated. Following the completion of a comprehensive survey of the rural area a basic plan of development has been formulated. During the year 49 villages were connected to the Board's system and of the 1,209 villages and hamlets with ten or more premises 992 had electricity, while work was in progress at the end of March last to supply 57 others. At that date the total number of consumers in the Area was 730,402, an increase during the year of 28,302.

Referring to sales of apparatus at service centres, the total value of which amounted to £411,657, the report says that sales to the public showed little change but those to local authorities were substantially reduced, these authorities now being able to buy from the manufacturers on the same terms as the Board. A uniform hire-purchase scheme was made available for the whole Area, applicable to a limited range of approved appliances the use of which will not greatly affect the peak load. No further apparatus will be issued on simple hire.

Dealing with system construction work it is stated that as an interim measure, pending the establishment of national standards, comprehensive specifications and technical instructions governing the various constructional methods and types of equipment in the Area have been prepared and are now in general use.

In the section of the report relating to personnel, it is mentioned that seven claims have been made against the Board under the Electricity (Staff Compensation) Regulations, 1949, all being rejected by the Board. In three cases, where the claims were made for loss of employment, the Board was informed that appeals were to be submitted.

Referring to the increased charge in the accounts for superannuation, the report states that this is primarily due to the inception of the North Eastern Electricity Board Superannuation (Protected Persons) Scheme under which the Board pays double the rate payable by the employees.

NORTH WESTERN

Consumption per head of the population in the North Western Area rose to 1,009 kWh and per consumer to 3,460 in the year ended 31st March last. Supplies to industrial consumers amounted to 2,617·2 million kWh (56·5 per cent of the total sales) and 547 new consumers of this class were connected. In rural areas, supplies were provided to 664 additional farms, making the total served 10,951, or about 53 per cent of all the farms in the Area ; this compares with a proportion of 36 per cent of electrified farms in the country as a whole. In the northern part of the Area there are some 50 small villages without electricity, but apart from this there are few remaining unsupplied.

The rate of domestic development is indicated by the number of major household appliances connected during the year,

Sales of Electricity and Price per kWh Sold in 1949-50 (1948-49 in italics)

Board	Total Sales		Domestic 2-Part Tariff		Large Power	
	Mill. kWh	Price d	Mill. kWh	Price d	Mill. kWh	Price d
North Eastern	2,781·3	1·02	151·8	1·21	1,859·7	0·79
	2,595·0	*1·00*	*115·3*	*1·13*	*1,728·3*	*0·79*
North Western	1,630·9	1·12	1,321·8	1·12	2,483·2	0·89
	4,445·5	*1·09*	*1,325·9*	*1·02*	*2,329·0*	*0·89*
S.E. Scotland	884·5	1·23	270·6	1·22	396·7	1·00
	824·5	*1·19*	*261·6*	*1·11*	*349·0*	*0·98*
S.W. Scotland	2,332·4	1·05	686·6	1·05	1,211·7	0·95
	2,294·4	*1·00*	*725·4*	*0·94*	*1,181·2*	*0·94*

namely, 19,171 cookers (making 232,971), 5,974 wash-boilers (83,665), 10,869 immersion heaters (125,300) and 2,532 self-contained water heaters (34,352). Tariffs were under review with the object of simplifying and standardizing existing scales, and in the case of street lighting new uniform charges were introduced.

System development works carried out added 143·5 miles to the high-voltage network and 368·4 miles to the low-voltage system. Reinforcement schemes were in hand for supplies to Burnley, Bredbury, Bolton, Leyland, Rochdale and Wigan.

SOUTH EAST SCOTLAND

Nearly twice as many farms were connected to the South East Scotland Board's system during 1949–50 as during the previous year (192 against 89), making the total number served 1,414. In all there were 315,400 consumers at the end of March, an increase of 18,380.

The year saw considerable progress in the extension of the use of electricity. For example, following an investigation into the off-peak heating of buildings two interesting installations are being carried out. In one, provision is made for electric floor warming; in the other electrode boilers will be used with thermal storage cylinders. Nurserymen and market gardeners have shown increased interest in low voltage soil warming, of which a number of new installations were provided during the year. Experiments have been carried out in electrical warming to assist the germination of barley, and floor warming has been applied successfully in pig farrowing pens.

New service centres were opened during the year at Lochgelly, Leven, Stirling and Alloa, and premises were secured at Dunbar and Bo'ness. Apparatus to the value of £223,000 was sold, including 3,200 cookers, 350 water heaters, 1,300 wash boilers and 1,000 washing machines. Further consideration was given to the formation of standard tariffs. To encourage the use of battery vehicles a special off-peak battery charging tariff was introduced.

The volume of engineering construction work in hand increased by some 50 per cent. One of the more important projects is that of catering for the large increase in load in the Edinburgh Sub-Area expected during the next few years. A joint examination with the Central Authority established that a saving in capital expenditure of £314,000 could be secured by extending the 132 kV grid into the city to feed the Board's 33 kV system at two new points.

A subject of contention during the year was the disposal of the reserves of the former electricity undertakings and the various representations made are outlined.

SOUTH WEST SCOTLAND

Major reinforcement schemes have been prepared by the South West Scotland Board as follows (Sub-Areas and estimated cost):—Glasgow, £821,000; Lanarkshire, £497,500; Ayrshire, £1,200,000; Dumfries and Galloway, £177,430; Clyde, £166,400. Work carried out during 1949–50 on system development involved a cost of £1,778,000. Bulk orders were placed for cables, transformers and motor vehicles and this method of purchasing has now been extended to meters and temporarily to insulators; otherwise purchases are made at Sub-Area level under the supervision of the chief purchasing officer.

At the beginning of the year 348,861 consumers were receiving a.c. supplies at non-standard voltages. At little expense to the Board and none to the consumers 340,911 of these were changed to the standard 415/240 V, but conversion of the remainder will be costly and will take some time. Since vesting day the number of d.c. consumers has been reduced from 24,103 to 18,289 and as it is uneconomic to provide supplies of this kind to the few remaining d.c. consumers in Dumfries and Hamilton the work of conversion is to be pressed forward.

An additional 26,222 consumers were connected last year, making the total number 684,964. With 432 further farms provided with a supply during the year the number served rose to 4,937, or approximately 50 per cent of those in the Area. Schemes (estimated to cost £2,624,000) were prepared for the systematic development of the rural parts of each Sub-Area (except Glasgow). As the first step towards tariff uniformity proposals were approved for a domestic block rate tariff. This has since replaced more than fifty existing tariffs, the Board being the first of the fourteen to carry out standardization on these lines.

EUROPEAN ELECTRICITY

A MEETING called by the Electric Power Committee of the United Nations Economic Commission for Europe was held in private in Geneva last month, when the Committee's group of experts for the study of legal questions considered matters relating to the development of frontier rivers and lakes and international exchanges of electrical energy. In the absence of Sig. Marco Visenti (Italy) through illness M. Ch. A. Crescent (France) was elected chairman of the session.

It was decided to request the preparation of a model agreement to facilitate the development of hydro-electric resources of rivers and lakes of interest to two or more countries. This would include fiscal, customs and payments guarantees the absence of which discourages development efforts. The E.C.E. legal group also envisaged the eventual creation of companies under international law which would be responsible for the construction and exploitation of such resources. This is a new legal conception in electrical development. The secretariat was asked to prepare a study on this subject.

In an effort to promote "guaranteed exchanges" of electrical energy between any two countries (annual contracts providing for energy exports by one country during a certain season and imports during another season), the secretariat was asked to submit a draft text of a convention providing a uniform law and instituting a simplified procedure for such exchanges. One object sought by this convention is to place these exchanges on the basis of a simple authorization of the ministry in charge of electricity. In most Western European countries the authorization of several ministries, as many as ten in one case, is now required. The secretariat was also asked to prepare a draft convention dealing with occasional exports of electricity.

After its comparative study of national legislation covering exports and imports of electrical energy, the group decided that legislation of the present type on the export of energy for cash should be maintained. It was believed, however, that countries might effect simplifications suggested by the comparison of the legislation of the different countries.

E.I.B.A. FUNCTIONS

THE Electrical Industries Benevolent Association announces the following meetings and functions:—18th January: Newcastle Branch annual general meeting. 19th January: E.D.A. (Northern Counties) carnival, Newcastle. 24th January: Rugby Branch annual general meeting. 26th January: Hampshire Branch annual ball, Southsea. 2nd February: North Staffordshire, annual ball. 16th February: Birmingham Branch annual ball. 23rd February: Middlesbrough Branch ball. 23rd February: Derby Branch ball. 1st March: Glasgow Branch "Plaza Night." Full details of these functions may be obtained from the local branch secretary, or from E.I.B.A. headquarters at 32, Old Burlington Street, London, W.1.

LIGHTING AT SOUTHAMPTON

A SODIUM street lighting installation covering about five miles of the Portsmouth-Bournemouth main road at the eastern and western approaches to Southampton was switched on recently by the Mayor of Southampton. The scheme was planned to Ministry of Transport requirements by Mr. F. L. Wooldridge, engineer to Southampton Corporation, and employs 221 open type lanterns on 25ft concrete columns at an average spacing of 120ft. All the lanterns, "Osram" 140 W sodium lamps and auxiliary control gear have been supplied by the General Electric Co., Ltd. The illumination is 5,230 lumens per 100ft linear of road. The G.E.C. lantern used has a die-cast light alloy body. Its optical system is designed to ensure uniform illumination of the whole road surface, the light being controlled by prismatic refractor plates. The prisms are sealed to a plain glass panel so that the inside and outside surfaces of the refractor plates are smooth, to facilitate cleaning.

Sodium lighting along main Portsmouth-Bournemouth road at Southampton

NEXT WEEK'S EVENTS

Monday, 8th January

BATH.—Technical College, 6 p.m. I.E.E. Western Centre. Lecture on "Oliver Heaviside," by Prof. G. H. Rawcliffe.

BIRMINGHAM.—Imperial Hotel, Temple Street, 6 p.m. I.E.E. South Midland Supply & Utilization Group. Students' short papers.

IPSWICH.—Great White Horse Hotel, 6.30 p.m. I.E.E. District Meeting. "Some Notes on Electrical Installations in large Chemical Factories," by D. B. Hogg.

LIVERPOOL.—Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "The Determination of Time and Frequency," by H. M. Smith.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. The Students' Lecture. "Switchgear," by L. Drucquer.

NEWCASTLE-ON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "The Cost and Efficiency of Earthing on L.V. and M.V. Overhead Line Systems," by L. Gosland.

NOTTINGHAM.—E.M. Gas Board's Showrooms, Parliament Street, 6.30 p.m. Nottingham Society of Engineers. "Application of Electricity to Industry," by E. L. N. Towle.

Tuesday, 9th January

BELFAST.—Queen's University, 6.45 p.m. I.E.E. Northern Ireland Centre. Lecture on "Fifty Years' Development in Telephone and Telegraph Transmission in Relation to the Work of Oliver Heaviside," by Dr. W. G. Radley.

DERBY.—Electricity Showrooms, 6.30 p.m. I.E.E. East Midland Centre. "Personnel, their Selection, Training, Appraisement and Promotion," by Col. C. E. Calveley.

LEEDS.—B.E.A. Yorks. Division, 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "The Continental Development of Single-Anode Mercury-Arc-Rectifier Valves of High Power," by Dr. -Ing. H. von Bertele.

LONDON.—Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Brightness Engineering," by W. Robinson.

At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers. "Local Line Development," by R. M. Richards.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Development and Design of H.V. Impulse Generators," by F. S. Edwards, F. R. Perry and A. S. Husbands.

RUGBY.—E.M.E.B. Little Church Street, 6.30 p.m. I.E.E. Rugby Students' Section. "The Students' Lecture," by K. J. R. Wilkinson.

Wednesday, January 10th

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North-East Scotland Sub-Centre. "Some Electrical Methods of Measuring Mechanical Quantities," by F. J. Woodcock.

BIRMINGHAM.—James Watt Institute. I.E.E. South Midland Students' Section. "The Electrification of Textile Mills," by H. Law.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. Scottish Centre. "The Continental Development of Single-Anode Mercury-Arc-Rectifier Valves of High Power," by Dr. -Ing. H. von Bertele.

City Lighting and Cleansing Department, High Street, 7 p.m. I.E.S. Edinburgh Centre. "Art and Science of Lighting in the Home," by Miss M. D. Wardlaw.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. "The Use of Saturable Reactors as Discharge Devices for Pulse Generators," by W. S. Melville.

At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. Institution of Heating & Ventilating Engineers. "Contra-Rotating Axial Flow Fans," by R. H. Young.

London School of Hygiene & Tropical Medicine, W.C.1, 6.30 p.m. British Institution of Radio Engineers. Symposium on Hearing Aids.

NEWCASTLE-ON-TYNE.—County Hotel, 7 p.m. I.E.S. Newcastle Centre. Annual dinner.

NORTHAMPTON.—Northampton & District Electrical Association, 7.15 p.m. "X-Rays in Industry," by E. J. Grimwade.

PENGAM.—Britannia Mining School, 6 p.m. Association of Mining Electrical & Mechanical Engineers (South Wales Branch). "Mines Electrical Report," by J. Cowan.

Thursday, 11th January

BRIDGEND.—Technical College, 6 p.m. As under Pengam, 10th January.

DUNDEE.—Royal Hotel, Union Street, 7 p.m. I.E.E. North-East Scotland Sub-Centre. "Some Electrical Methods of Measuring Mechanical Quantities," by F. J. Woodcock.

DUNFERMLINE.—Unitas Hall, Queen Anne Street, 7 p.m. Dunfermline & District Electrical Society. "Overhead Transmission," by A. Erskine.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, 6 p.m. I.E.S. Glasgow Centre. "Lighting in the Home," by Miss M. D. Wardlaw.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "Development and Design of High-Voltage Impulse Generators," by F. S. Edwards, F. R. Perry and A. S. Husbands.

MANCHESTER.—College of Technology, Sackville Street, 6 p.m. I.E.S. Manchester Centre. "The Contractor Sheds Some Light," by F. Ainscow.

SWANSEA.—Plaza Cinema, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. Report on "The Education and Training of Electrical Technicians." To be presented by Dr. F. T. Chapman.

Saturday, 13th January

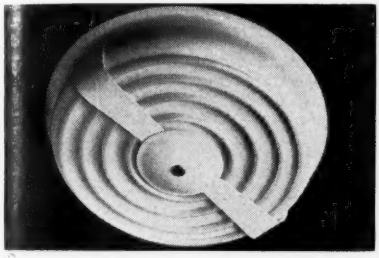
LEEDS.—Y.E.B. Offices, Whitehall Road, 2.30 p.m. I.E.E. North Midland Students' Section. Main Centre chairman's address, by W. F. Smith.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Cold Cathode Lighting

AN attractive circular four-tube cold cathode lighting fitting has just been placed on the market by the BRITISH NEON MANUFACTURING & INSTALLATION CO., LTD., Cottenham, Cambridge, which by reason of its shape does not require the ceiling space usually necessary with this form of lighting. This "Suntube" fitting is a self-contained unit rated at 90 W 0·8 power factor on 200/250 V 50 c/s mains and incorporates a total lighted length of tube of 16ft. The standard tube colours available are two peach and two daylight, but other colours can be supplied. The fitting is 24in in diameter and is moulded from "Perspex," normally cream and white.



"Suntube" cold cathode lighting fitting

Plug-in Starter

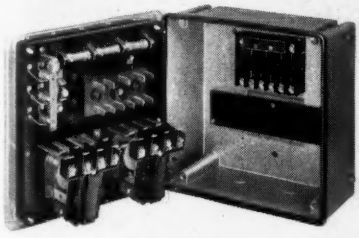
A new plug-in reversing starter made by EGA ELECTRIC, LTD., Wednesbury, Staffs, contains forward, reverse and stop buttons, isolator units, fuses and overloads in one compact unit, and is suitable for motors of from $\frac{1}{3}$ to 7·5 h.p. at 200–440 V, and 0·25–11 A. Operation of the forward button engages contacts and actuates the pivot arm which throws the reverse contacts out of circuit. Pressure of the reverse button similarly throws the forward contacts out of circuit. On test the starter has been found capable of about 60 reversals per minute. The unit is only $8\frac{1}{16}$in high, $4\frac{7}{8}$in deep and $5\frac{5}{16}$in wide and incorporates a complicated plastic base with many metal inserts made by Lorival Plastics.

Cinema Arc Rectifiers

Many improvements are embodied in the new and redesigned cinema arc rectifiers introduced by the NEVELIN ELECTRIC CO., LTD., Purley Way, Croydon, Surrey. Greater accessibility and ease of component replacement have been specially catered for, while better cooling and greater capacity of transformer and ignition relays are designed to give longer trouble-free operation. The operating characteristics of the new models are unchanged but an attempt has been made, in a number of ways, to anticipate the trend of requirements in the cinema industry.

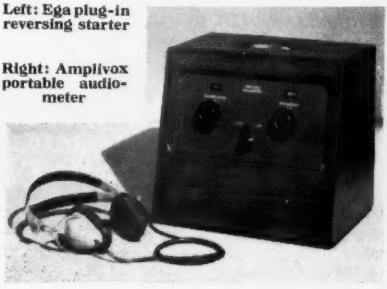
Portable Audiometer

To facilitate the early discovery of hearing impairment by routine audiometric tests AMPLIVOX, LTD., 2, Bentinck Street, London, W.1, has produced the Model 70 portable audiometer, a simply operated and inexpensive instrument, providing for air conduction testing at eight pure tones, with frequencies from 125 to 8,000 c/s and with a maximum intensity range of 100 db in 5 db steps. There is a single zero reference, so that the same figures are read on the hearing loss scale for all frequencies. This permits of testing by the rapid sweep check method. The instrument is for 100/250 V a.c. or d.c. mains and weighs only 14 lb. The price



Left: Ega plug-in reversing starter

Right: Amplivox portable audiometer



is 80 guineas complete with operative earphone and dummy both mounted on a headband, which, together with the mains lead, are carried in a lock-up compartment of the instrument when not in use.

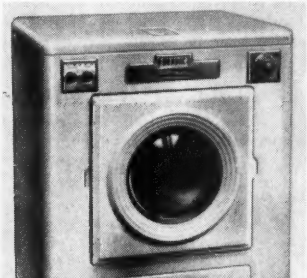
Electric Proportioning Controls

A new series of "Teddington" electric proportioning valves and controls is announced by the BRITISH THERMOSTAT CO., LTD., Sunbury-on-Thames, Middlesex. This series (Z.A.) provides full proportioning control of valves, dampers, motors, etc., in direct relation to changes in temperature, pressure or humidity. All-electric in operation, the power unit being connected to the controller by a single three-core cable, this system overcomes the limitations of self-contained and pneumatic systems and offers considerable scope for installation and layout. A comprehensive range of control combinations is available for maintaining constant conditions from a single control point; from a single control point with high and low limit control; to maintain compensated control from two control points, etc. The ease of installation and the adaptability of these controllers will appeal particularly to those who are concerned with the automatic regulation of industrial processes, air conditioning, heating and ventilation.

Improved Automatic Washer

The tumble-action of the automatic washer made by BENDIX HOME APPLIANCES, LTD., Albion Works, Kingsbury Road, Birmingham, 24, has been improved by the introduction of the "Dyna-Surge" cylinder which has perforated baffles to throw penetrating jets of hot soapy water on to the clothes. The back of the cylinder has been designed to ensure that the clothes turn and tumble in an elliptical path at each revolution. The water temperature control can be set for a hot or warm wash according to the fabrics being laundered, and the new "water rationer" meters out the exact amount of water to suit washing loads from 4 to 9lb, thus saving hot water and soap.

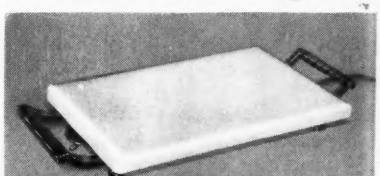
The time control dial gives up to 9¾ minutes for soaking and 12 minutes for washing, a thermostat giving positive water temperature control under all conditions. Another new feature is the reversible door which can be hinged on either the left- or right-hand side. A completely flat porcelain top provides an additional work surface. The new machine, model D, costs £69 10s (plus £17 10s P.T. in this country).



Bendix washer, model D and below: E.T.I. deep fryer

Warming Plate

A warming plate made by H.M.V. HOUSEHOLD APPLIANCES, LTD., Hayes, Middlesex, is claimed to be the first British made model with thermostatic control. The correct operating temperature is reached very quickly and is maintained steady by the special quick action of the thermostat. The full loading is about



H.M.V. warming plate

700 W and the average about 400 W. A switch on the side has an on/off indicator plate.

The plate measures 23in by 11in by 2½in and weighs 10lb. The ivory vitreous enamel finish of the plate is stain resisting and easy to clean. The price is £6 6s.

Deep Fryer

An electric deep fryer being brought out by ELECTRO TECHNICAL INDUSTRIES, LTD., 16, Berkeley Street, London, W.1, incorporates a die-cast aluminium well 12in long by 5in deep by 8in wide, fitted with a wire basket with a non-drip attachment. It is finished in white enamel. A thermostat keeps the oil or fat at the correct cooking temperature (365–400 deg F). and the rating is 2 kW. The appliance, which is suitable for a.c. only, can be used to deep fry fish, chipped potatoes, meat croquettes, chicken, etc., and is suitable in size for preparing a variety of food for up to a dozen people.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Aerialite, Ltd.—The annual meeting was held on 21st December, Mr. L. S. Hargreaves (chairman and managing director) presiding. In his statement circulated with the report and accounts the chairman said that the turnover for the year under review was up over 20 per cent and the increase was being more than maintained in the current year. Their subsidiary, Nettle Accessories, Ltd., and the African subsidiary, Aycliffe Industries, Ltd., had had satisfactory years. The parent company had developed certain types of new cables. The rearmament programme was having its effect upon them and they were having more demands made upon them from Government Departments. During the year they had extended their laboratory and testing facilities. Export orders were still being maintained and recently they had been able to obtain substantial orders from the dollar area.

Joseph Lucas, Ltd.—In his circulated statement Sir Peter Bennett (chairman) said that the company's turnover in all its activities increased by an average of 20 per cent. The physical output of electrical equipment for the motor industry was now double that of pre-war although the factory area in which it was produced was little greater than what was in use before the war. Progress by their designs, development and research organizations was continuous. In the motor-car field every effort was being made to improve still further the reliability of their products and to this end tropical testing stations had been organized in Central Africa where conditions were extremely exacting.

S. Smith & Sons (England), Ltd.—In the course of his speech at the recent annual meeting, Sir Allan Gordon-Smith (chairman) said, in referring to the various divisions, that the manufacturing facilities of Smiths English Clocks, Ltd., had been further developed and the demand had been an increasing one. Kelvin & Hughes, Ltd., continued to develop its range of marine, aviation and industrial instruments, and had had a satisfactory year.

International Combustion Africa, Ltd.—The annual meeting was held recently at Neave Township, Port Elizabeth, Sir George Usher (chairman) presiding. In presenting the report and accounts the chairman said that the new machine shop and foundry at Port Elizabeth were at present engaged on important contracts for the new power stations being built by the Electricity Supply Commission at Vierfontein, O.F.S., Umgeni, Natal, and Zwartkops, near Port Elizabeth, and in addition they had received several important export orders and further orders for other electricity undertakings in South Africa. During the year under review they had completed large contracts for the Bloemfontein Municipality's new power station and for the Electricity Supply Commission's power station at Congella. The directors had decided during the past year to more than double the area of the existing engineering works. It was their intention in the near future to increase the capital to cope with the largely enhanced order book. Their unfulfilled orders at the present time amounted to nearly £5,000,000. This year's trading account showed a considerable improvement on that of last year.

The Madras Electric Supply Corporation, Ltd., reports a balance for 1949, after providing £3,000 for taxation, of £7,402, as compared with £7,847 for 1948. After paying the preference dividend, a balance of £6,559 is carried forward (against £24,006 brought in).

Aeronautical & General Instruments, Ltd., announces that because of a trading loss for the year ended 31st March, 1950, no ordinary dividend is recommended in respect of that year. The dividend for the previous year was 5 per cent.

New Companies

Greenhalgh & Duxbury, Ltd.—Registered 23rd December. Capital £10,000. To acquire the electrical engineering business of S. Greenhalgh carried on by him at Stanley Court, off The Rock, Bury. Directors: S. Greenhalgh and A. Duxbury. Regd. office: 3, Stanley Court, off The Rock, Bury.

Michael Dix, Ltd.—Registered 23rd December. Capital £100. Lighting consultants and manufacturers of and wholesale and retail dealers in electrical appliances of all kinds, etc. Directors: M. Dix and Mrs. Iris C. L. Dix. Regd. office: 22, Manor Park Road, East Finchley, N.2.

S. Burke (Radio), Ltd.—Registered 22nd December. Capital £1,000. Manufacturers of and wholesale and retail dealers in electrical

goods of all kinds, wireless and television sets, etc. S. Burke is the first director. Regd. office : 28, Falcon Road, S.W.11.

Harvey Electronics, Ltd.—Registered 27th November. Capital £1,000. Electronic and electrical manufacturers, etc. Directors : J. P. Harvey and Mrs. Claire M. E. Harvey. Regd. office : 4, Downing Street, Farnham, Surrey.

Pearce Transformer Co., Ltd.—Registered 25th November. Capital £10,000. Electrical equipment and scientific instrument specialists, etc. Directors : H. J. Pearce, Lt.-Col. J. H. G. Pearce and F. W. Allen. Regd. office : Standard House, 52/54, Gray's Inn Road, W.C.1.

A. E. Bird (Electrical), Ltd.—Registered 5th December. Capital £1,000. Manufacturers of and dealers in electrical, gas and oil lamps, fires, stoves, cookers, radio, television, etc. Directors : A. E. Bird and J. F. Bird. Regd. office : 208, Kent House Road, Beckenham, Kent.

Frederick Dale, Ltd.—Registered 1st December. Capital £400. Electrical and mechanical engineers, contractors and advisers, etc. Directors : F. T. Dale and Miss Jean A. Wensley. Regd. office : 145a, High Street, Bromsgrove, Worcs.

S. B. Davenport, Ltd.—Registered 11th December. Capital £1,000. Mechanical and electrical engineers, electricians, etc. Directors : S. B. Davenport and Mrs. Edith F. Davenport. Regd. office : 15, Cotswold Street, West Norwood, S.E.27.

Farrer Bros. (Kent), Ltd.—Registered 9th December. Capital £100. Electrical engineers and contractors, etc. Directors : L. G. Farrer and Mrs. Josephine M. Farrer. Regd. office : 143a, Wincheap Street, Canterbury.

Relay Vision, Ltd.—Registered 9th December. Capital £10,000. Directors : W. Kirkham and F. Nuttall. Regd. office : 57, Abbey Street, Accrington.

Walker-Troup Electrics, Ltd.—Registered in Edinburgh 7th December. Capital £2,000. Directors : H. Troup, W. Walker, J. Craig and J. A. M. Robb. Regd. office : 25, Crown Street, Aberdeen.

Metro-Radio (Pinner), Ltd.—Registered 13th December. Capital £1,000. Manufacturers of and dealers in electric and mechanical apparatus and accessories, etc. Directors : Mrs. Ada Densham and Peter Densham, both of 67, Sussex Road, North Harrow, Middlesex.

Increases of Capital

G.W.B. Electric Furnaces, Ltd.—Increased by £15,000, in ordinary £1 shares, beyond the registered capital of £10,000. At 7th July, 1949, 5,000 shares of £1 had been issued, of which Gibbons Bros., Ltd., held 2,497 shares and Wild-Barfield Electric Furnaces, Ltd., held 2,498 shares.

Horace Green & Co., Ltd.—Increased by £50,000, in £1 shares, beyond the registered capital of £100,000.

Chaplin Bros. (Birmingham), Ltd.—Increased by £17,000, in £1 ordinary shares, beyond the registered capital of £3,000.

Supra Electrical Co., Ltd.—Increased by £6,000, in £1 ordinary shares, beyond the registered capital of £4,000.

Smith & Cookson, Ltd.—Increased by £40,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Liquidations

Llanfair Caereinion Electric Society, Ltd.—Winding up voluntarily. Liquidator, Mr. A. H. Morgan, Crown Chambers, 18, Market Street, Newtown, Mont.

Gourlay Electrical, Ltd.—Meetings 30th January at 41, North John Street, Liverpool, 2, to receive an account of the winding-up by the liquidator, Mr. E. S. Browne.

Tok Switches, Ltd.—Members' voluntary liquidation. Particulars of claims by 22nd January to the liquidator, Mr. F. W. Charles, 11, Ironmonger Lane, London, E.C.2.

Bankruptcies

L. G. Sharp, 4, Summerley's Road, Princes Risborough, Bucks, electrician.—Receiving order made 14th December on debtor's own petition.

A. Ball, electrical engineer, lately carrying on business at 10, Wild Buildings, Birstall, Yorks.—Receiving order made 14th December on a creditor's petition.

First meeting 5th January at the Official Receiver's office, Hallfield Chambers, 71, Manningham Lane, Bradford. Public examination 15th February at the County Court House, Eightlands, Dewsbury.

P. H. Leach, 4, Oxford Street, Guiseley, near Leeds, radio and electrical engineer, lately residing at 4, Oxford Street, Guiseley, and carrying on business at 4, Oxford Street, Guiseley and 6 & 8, Town Street, Yeadon, Yorks, as a radio and electrical engineer under the style of P. H. Leach.—First meeting held 2nd January. Public examination 13th February at the Court House, Albion Place, Leeds.

J. Barnett and M. Barnett, trading in partnership as Barnett Supplies Co., 102 & 104c, Cranbrook Road, Ilford, Essex, radio, electrical and television dealers and contractors.—Last day for receiving proofs for dividend 12th January. Trustee, Mr. N. W. Osborne, 11-12, Finsbury Square, London, E.C.2.

STOCKS and SHARES

ON the average, and after many vicissitudes shares in the Stock Exchange industrial markets finished 1950 well ahead of their starting prices. In doing so, they reversed the depression which had persisted more or less continuously over the three preceding years. Markets opened the year well and, having negotiated the Budget and General Election without positive harm, had developed a decidedly bullish appearance before this complexion was changed by the outbreak of the Far Eastern trouble in June. After the recoil, however, progress was resumed to such good purpose that many shares touched, and held, their top prices during the autumn. Reactions to the latest political developments have brought them well below the best, but have failed to eliminate some very useful net appreciation.

Gilt-edged Stocks' Improvement

Confidence, and prices, in the gilt-edged market have been buttressed against recurrent bad news by steady and striking improvement in the balance-of-trade figures, and, consequently, in the sterling area's gold and dollar reserves. The degree of confidence so engendered can be judged by the equanimity with which news of the suspension of Marshall Aid was received. The market has derived support, too, from the impression of Treasury intentions to keep money cheap, particularly in view of the approaching operation to take over steel company shareholdings in exchange for Government stock. In common with other Government issues, both the 3 per cent British Electricity loans retain a moderate gain over the year, the 1968-73 issue being 1¼ points to the good at 96¾ and the 1974-77 stock having gained about 2½ to 96½. The new 3½ per cents 1976-79 were issued in May at 99, and finish the year at 102¾.

Electrical Equipment Shares

Events have firmly maintained investment confidence in electrical equipment and engineering shares, as the following table indicates;

Company	End December 1949	1950	Rise
	s. d.	s. d.	s. d.
Associated Elec. Ind. ..	70 0	85 0	15 0
Crabtree Electrical ..	32 6	39 0	6 6
Elec. Construction ..	46 6	61 3	14 9
English Electric ..	42 6	47 6	5 0
G.E.C.	74 6	82 0	7 6
Reyrolle	57 6	76 3	18 9

the majority of them have given a good account of themselves. Trade and individual company news has been encouraging and, with accumulating evidence that the policy of dividend limitation is giving way to one of moderation, many shareholders are entertaining the idea of a better return from the past year's earnings.

Cables and Telephones

Including as it does some of the most austerely conservative dividend-payers, the cable and telephone group has been well supported in anticipation of the results and rewards for 1950. Judging by current prices and yields, it is evident that investment prospects in this field are still assessed highly in the face of rearmament, and of raw material shortages and costs :

Company	End December 1949	1940	Rise
	s. d.	s. d.	s. d.
Automatic Telephone..	54 6	62 0	7 6
British Insulated Callender's	32 0	33 6	1 6
Enfield Cable	28 3	32 0	3 9
Henleys	22 6	23 6	1 0
Johnson & Phillips ..	60 9	62 0	1 3
Siemens	30 0	31 3	1 3
Telegraph Construction	36 3	42 6	6 3
Telephone Manufacturing	8 6	10 6	2 0

Miscellaneous Groups

Uncertainty as to the extent to which Government orders may interfere with the peaceful development of television, came in the closing weeks of the year to obscure the distinct promise of the market concerned. Late support for the shares has, however, left a majority of net gains, as is shown by those included in this table :

Company	End December 1949	1950	Rise
	s. d.	s. d.	s. d.
Brush	6 3	6 6	3
Cossor	8 6	11 3	2 9
Decca	12 6	13 9	1 3
E.M.I.	18 0	19 6	1 6
Tube Investments ..	57/6	63/6	6 3
Walsall Conduits	53 9	56 3	2 6

To sum up, it may be fairly claimed that the past year's performance of the various sections of the electrical engineering markets will fortify shareholders in the conviction that, whatever lies in store, their capital is soundly invested. During the year just ended there have been a good many new issues and reorganizations of capital, one effect of which is to render it practically impossible to compare to-day's quotations with those of twelve months ago. For this reason, various instances which would otherwise have appeared in our tables, are necessarily omitted. It will be noticed that in every case quoted overleaf a rise in price has occurred over the year, and, however obscure the prospect is for 1951, a certain amount of negative consolation can be drawn from the steadiness of prices during 1950.

Electrical Investments

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price Jan. 1 1950	Month's Rise or Fall	Yield p.c. £ s. d.
Overseas Electricity Companies					
Atlas Elec. ..	2½	3	16/3	—5d	3 13 10
Calcutta Elec. ..	6†	6†	22/9	—1/9	5 5 6†
Cawnpore Elec. ..	—	—	27/6	—1/16	—
East African Power	7	7	37/6	+1/16	3 11 4
Jerusalem Elec. ..	—	—	11/-	—	—
Madras Elec. ..	—	—	32/6	—1/16	—
Nigerian Elec. ..	10	10	30/9	—	6 10 1
Palestine Elec. "A"	5†	5†	21/6	—1/-	4 13 0†
Perak Hydro-Elec.	Nil	Nil	8/6	—¼	—
Whitehall Inv. Pref.	6	6	23/6	—	5 1 4
Equipment and Manufacturing					
Aberdare Cables(5/-)	15	20	13/9	—9d	7 5 6
Aron Elec. Ord. ..	15	15	38/9	—⅛	7 14 0
Assoc. Elec. Ord.	15	15	85/-	+½	3 10 9
AutomaticTel.& El.	12½	12½	62/-	+6d	4 0 8
Babcock & Wilcox	15	15	67/-	+2/-	4 9 8
Baldwin, H. J. (2/-)	25	25	5/9	—	8 14 0
British Aluminium	10	10	59/6	+1/-	5 1 3
B.I. Callender's ..	6⅝	6⅝	35/6	—1/6	3 19 8
British Thermostat (5/-)	25	30	30/-	—⅛	5 0 0
British Vac.Cleaner (5/-)	20	20	10/3	—1/9	9 15 2
Brush Ord. (5/-) ..	10	10	6/6	—	7 12 10
Burco (5/-) ..	35	42½	21/6	—⅛	8 13 6
Chloride El. Storage	20	12½*	57/6	—	3 9 6‡
Cole, E. K. (5/-) ..	20	20	18/-	+6d	5 11 1
Cossor, A. C. (5/-)	Nil	Nil	11/3	+1/9	—
Crabtree (10/-) ..	17½	17½	39/-	—	4 9 9
Crompton Parkinson Ord. (5/-) ..	22½	11¼	11/6	—1/-	4 17 9
De La Rue (5/-) ..	50	50	28/3	+5/9	8 17 0
Decca (1/-) ..	112½	112½	13/9	—	8 3 6
E.M.I. (10/-) ..	8	8	19/6	—	4 2 1
Electrical Components (5/-) ..	20	20	11/3	—	8 17 10
Elec. Construction	12½	15	61/3	—	4 18 0
Enfield Cable Ord.	7½	7½	32/-	—	4 13 9
English Electric ..	10	10	47/6	—	4 4 2
Ericsson Tel. (5/-)	20†	20†	41/9xb	—	—
Ever Ready (5/-)	40	35	27/6	—1/6	6 7 3
Falk Stadelmann	15	15	42/6	+⅛	7 1 2
G.E.C. Ord. ..	17½	17½	82/-	—5d	4 5 4
General Cables(5/-)	38	30*	17/6	+2/-	6 11 6
Greenwood & Batley	15	15	17/6	—	6 6 0
Hackbridge Cable (5/-)	—	20	11/6	—3d	6 18 0
HackbridgeHewittic (5/-)	12½	15	15/6	—6d	4 16 9
Hall Tel. Acc. (10/-)	10	10	16/-	+6d	6 5 0
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	23/6	—	4 7 6
Hoover (5/-) ..	40	45	25/9xr	—	—
Intl. Combustion (5/-)	37½	21*	16/6	+3d	4 11 0‡
Johnson & Phillips	15	15	62/-	—	4 16 9

Company	Dividend Previous	Dividend Last	Middle Price Jan. 1 1950	Month's Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing (continued)					
Lancashire Dynamo	22½	22½	96/3	—⅛	4 13 8
Laurence,Scott(5/-)	12½	12½	12/9	—1/16	4 18 1
London Elec. Wire	10	10	46/-xr	-	4 7 0
J. Lucas	17½	6⅔*	33/9	+1/-	3 19 0
Mather & Platt ..	11	11	39/6	—6d	3 14 1‡
Metal Industries ..	10	10	43/2	—	4 12 6
Mid. Elec. Mfg. ..	35	12½*	57/6	+⅛	4 6 10‡
Murex	20	10*	49/-	+1/6	4 1 8
Newman Ind. (2/-)	17½	10	3/3	—6d	6 3 1
Oldham & Son (1/-)	60	30*	5/-	—	6 0 0
Parsons C. A. ..	12½	15	76/3	+1/16	3 18 9
Plessey (5/-) ..	20	20	17/-	—1/9	5 17 8
Pye Deferred (5/-)	25	35	36/3	—	4 16 7
Radio & Tel. (2/-)	—	—	6d	—	—
Revo (10/-) ..	27½	27½	44/6	—	6 2 3
Reyrolle	12½	15	76/3	+1/16	3 18 9
Scophony Baird(1/-)	—	—	1/6	—	—
Scot. Cable (4/-) ..	30	30	23/-	—6d	5 2 3
Siemens Ord. ..	7½	7½	31/3	—	4 16 0
Switchgear&Cowans (5/-)	20	20	15/-	—	6 13 4
T.C.C. (10/-) ..	15	15	32/6	—	4 12 4
T.C. & M. ..	10	9*	42/6	—6d	4 4 5
Telephone Mfg.(5/-)	9	10	10/6	—6d	4 15 3
Thorn Elec. (5/-)..	20	20	20/-	—	5 0 0
Tube Investments	25	25	6¼	—⅝	4 0 9
Vactric (5/-) ..	Nil	Nil	7/6	—1/16	—
Veritys (5/-) ..	5	2½	3/3	—3d	3 17 0
Walsall Conduits (4/-)	70	70	56/3	—	4 19 6
Ward & Goldstone (5/-)	50	11*	38/6	—	5 4 0‡
Watford (2/-) ..	20	20	7/-	—3d	5 14 3
Westinghouse Brake	14	14	61/3	—⅛	4 11 4
West, Allen (5/-)..	10	10*	10/6	—	4 15 3
Transport and Communications					
Anglo-Am. Tel.: Pref.	6	5⅓	87	—3½	6 9 6
Def.	—	—	15	—2	—
Anglo-Portuguese	8	8	25/-	—1/-	6 8 0
Brit. Elec. Traction: Def. Ord. ..	50	32½*	515	+60	4 8 0‡
Cable & Wireless: Ord.	—	—	93	—	—
4% Loan ..	—	—	101	—	3 19 3
Calcutta Trams ..	6†	6†	27/6	—⅜	4 7 3†
Cape Elec. Trams	6	4	15/-	—	—
Globe Tel. & Tel. Ord.	—	—	20/3	—	—
Great Northern Tel. (£10)	8	7	12¼	—1	5 14 3
Inter. Tel. & Tel.	Nil	15 cts	27	—1	—
Marconi Marine ..	7½	7½	25/-	—	6 9 0
Oriental Tel. Ord.	16	16	42/-	—1/9	7 12 1
Telephone Props.	6	7	22/6	—	6 4 5
Tele. Rentals (5/-)	10	10	11/-	—3d	4 11 0

* After capital bonus.
† Dividends are paid free of Income Tax.
‡ Yield adjusted to capital bonus issue.

CONTROL

IN STOCK

(WITHOUT ISOLATOR)
FITTED WITH NOVOLT AND THREE OVERLOAD RELEASES
3-PHASE 50 CYCLES 400/440 VOLTS

SIZES :

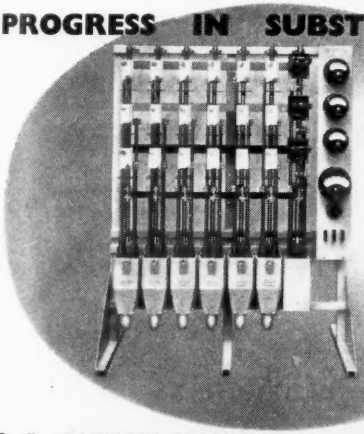
5 H.P.	12.5 H.P.
7.5 H.P.	15 H.P.
10 H.P.	20 H.P.
25 H.P.	

A'R BREAK
STAR-DELTA STARTER

VERITYS LTD.
Works : ASTON, BIRMINGHAM 6

Sales Headquarters : BRETTENHAM HOUSE
LANCASTER PLACE, W.C.2

PROGRESS IN SUBSTATION L.T. SWITCHGEAR



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DENNIS

CVS-17

2 GREAT NEW RAWLPLUG WALL PLUGS SELLERS!

These new masonry drilling tools are winners—no doubt of it! They're so much quicker and easier to use, so much more efficient, that they supersede every other method. When your customer wants to drill brick, stone, tiles or marble,—

SELL A RAWLPLUG DURIUM TIPPED MASONRY DRILL

It's tipped with a new type of metallic carbide having an exceptional degree of toughness and will outlast any steel or alloy known. *It has many times the life of ordinary drills.* (Made in sizes 6 to 20). This remarkable drill can be used with a hand brace, but for the customer for whom masonry drilling is a fairly frequent job,—

SELL A RAWLPLUG R.P.1. SLOW SPEED ELECTRIC DRILL

Light and comfortable (under 5 lbs.) yet robust and powerful, built for real hard work over the years. Chuck speed running light is 600 r.p.m., stepping down to 450 r.p.m. at full load — the ideal speed for Durium drills. Universal AC/DC Motor, available in three voltages — 100/110, 200/220, and 230/250. The two new lines are natural and inevitable *sellers*, simply because they are far and away the best answer to the problem of fast and accurate masonry drilling. Packed in strong labelled boxes for attractive counter display.

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1940

6521. Pye, Ltd., and Lawson, D. L.—Direction-finding equipment. 1st March, 1948. (619701.)

1945

1379. Igranic Electric Co., Ltd., Taylor, J. R., and Ilford, J. M.—Electric control apparatus. 14th March, 1946. (649501.)

31492. Submarine Signal Co.—Electron discharge apparatus. 22nd November, 1945. (649571.)

1946

2040. Sangamo Weston, Ltd., and Lovegrove, H. J.—Electrical measuring instruments. 21st January, 1947. (649574.)

3987. Standard Telephones & Cables, Ltd., Fremlin, J. H., and Hall, R. N.—Electron discharge devices of the electron velocity modulation type. 31st January, 1947. (649761.)

29885. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Devices for locating picture-plates in succession so as to be substantially normal to the light-path of a projection apparatus. 7th October, 1946. (649766.)

30423. British Thomson-Houston Co., Ltd.—Phase convertors. 11th October, 1946. (649768.)

31457. Emion Holdings, Ltd., Janser, A. M. J., and Townsend, C. S.—Apparatus for subjecting liquid material to electrical treatment. 24th November, 1947. (649576.)

35462. Philips Lamps, Ltd.—Acoustic instruments provided with diaphragms. 29th November, 1946. (649707.)

1947

6130. Johnson & Phillips, Ltd., Hollingsworth, P. M., and Best, W. B.—Electric cables. 5th April, 1948. (649708.)

7818. Standard Telephones & Cables, Ltd.—Electrical circuits for the production of subjective auditory effects. 21st March, 1947. (649709.)

10098. Indiana Steel Products Co.—Method of magnetically recording fluctuating electrical energy and the magnetic recorder for carrying out said method. 16th April, 1947. (649710.)

11572. Sperry Products, Inc.—Supersonic transmitting apparatus. 30th April, 1947. (649518.)

13423. British Thomson-Houston Co., Ltd.—Electric discharge devices. 19th May, 1947. (649523.)

14789. Philips Lamps, Ltd.—Devices for producing phase-modulated ultra-high-frequency oscillations. 4th June, 1947. (649524.)

19173. British Thomson-Houston Co., Ltd.—Pulse systems. 17th July, 1947. (649528.)

22750. Automatic Electric Laboratories, Inc.—Loud-speaking telephone substation equipment. 15th August, 1947. (649718.)

24308. Wallace & Tiernan Products, Inc.—Device for translating or converting electrical energy. 3rd September, 1947. (649720.)

27533. British Thomson-Houston Co., Ltd.—Eddy-current brakes and dynamo-electric machines. 14th October, 1947. (649533.)

27535. British Thomson-Houston Co. Ltd.—Eddy-current type brakes and dynamo-electric machines. 14th October, 1947. (649534.)

28086. Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges & Camargue.—Automatic regulation of electrolysis cells. 21st October, 1947. (619721.)

28341. Compagnie des Lampes.—Method for producing stemmed glasses through electric welding. 23rd October, 1947. (649726.)

28804/5. Andrews, E. F.—Stop-on-signal radio apparatus. 28th October, 1947. (649536/7.)

30926. Sutcliffe, H.—Electronic multiplying and dividing means. 8th December, 1948. (649779.)

31045. Philips Electrical, Ltd.—Photo-electric circuits. 24th November, 1947. (649724.)

32566. Farnsworth Television & Radio Corporation.—Passive impedance matching network. 10th December, 1947. (649587.)

33758. Freins Jourdain-Monneret.—Electro-magnetic track brakes for railway vehicles. 22nd December, 1947. (649784.)

34447. Zack, M.—Electric welding. 29th December, 1947. (649728.)

35181. Philips Electrical, Ltd.—Circuit arrangements for amplifying and separating two or more oscillations. 31st December, 1947. (649786.)

1948

888. Molins Machine Co., Ltd., Molins, D. W., and Chandler, E. A.—Electro-magnetic detecting devices. 20th December, 1948. (649789.)

8746. Collard, J.—Electrical waveguides. 5th March, 1949. (649732.)

11313. Newman, E. A.—Variable gain amplifiers. 21st April, 1949. (649793.)

11456. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Carrier wave telephone system transmitting arrangements. 26th April, 1948. (649595.)

12379. General Electric Co., Ltd., Dovey, A. P., Partridge, J. H., and Manners, M.—Glass solders. 13th April, 1949. (649600.)

13073. Bendix Aviation Corporation.—Electro-magnetic pump. 12th May, 1948. (649601.)

15553. Baird, Ltd., J. L., and Bernard, G. G.—Cathode-ray tube circuits for television receivers. 9th June, 1949. (649738.)

16796. British Broadcasting Corporation, Peachey, F. A., and Gunn-Russell, C.—Amplitude modulators for electric oscillations. 13th July, 1949. (649312.)

17340. General Electric Co., Ltd., and Sowter, A. B.—Cold welding of metal. 1st April, 1949. (649311.)

17880. Belling & Lee, Ltd., and Fountain, L. A.—Pin and socket type electrical connectors. 4th March, 1949. (649739.)

18181. Shelton, E. E., and Tomes, G. A. R. [trading as 20th Century Electronics].—Ionization counter tubes. 30th June, 1949. (649618.)

18247. Patelhold Patentverwertungs- & Elektroholding. Akt.-Ges.—Magnetrons. 7th July, 1948. (649619.)

18846. Automatic Telephone & Electric Co., Ltd., and Burns, G. A.—Electrical signalling systems. 29th June, 1949. (649742.)

19128. Westinghouse Electric International Co.—Combustion apparatus for gas turbines. 16th July, 1948. (649658.)

21606. British Thomson-Houston Co., Ltd.—Ceramic sealing compositions. 16th August, 1948. (649664.)

23610. English Electric Co., Ltd., and Hughes, J. O. P. —Side rods for locomotives. 26th August, 1949. (649745.)

26096. Grubb, R. G., and Morris, S. W. M.—Electric junction boxes, switch boxes and the like junction members. 5th October, 1949. (649748.)

26638. Singer Manufacturing Co.—Electronic seaming machines. 13th October, 1948. (649690.)

26884. Jones, E. H.—Tuned circuit arrangements. 15th November, 1949. (649749.)

27033. English Electric Co., Ltd., and Shaw, N. H.—Control systems for dynamo-electric machines. 7th October, 1949. (649556.)

27173. British Mechanical Productions, Ltd., Osborn, F. T., and Shorey, S. W.—Carriers for electrical fuses. 19th October, 1949. (649557.)

28039. Metropolitan-Vickers Electrical Co., Ltd., Gray, A. H., Fenwick, D. R., and Kuyser, J. A.—Electrical voltage regulating systems. 28th October, 1949. (649560.)

28141. British Thomson-Houston Co., Ltd., and Payne, K. J.—Automatic controllers for electric motors. 31st October, 1949. (649751.)

28673. Standard Telephones & Cables, Ltd., and Clarke, G. W.—Manufacture of coaxial cables. 28th October, 1949. (649624.)

28690. General Electric Co., Ltd., and Bayliss, A. J.—Radio communication systems. 26th October, 1949. (649752.)

28710. Metropolitan-Vickers-G.E.S., Ltd., and Kubale, J. S.—Track braking devices. 24th October, 1949. (649753.)

29634. Radio Corporation of America.—Concentric line resonator. 15th November, 1948. (649798.)

30321. British Thomson-Houston Co., Ltd.—Magnetic cores. 22nd November, 1948. (649627.)

31545. Descarsin, M.—Device for the heating by dielectric losses of tubes made of glass or other vitreous material. 30th January, 1945. (Divided out of 616251. (649757.)

31603. Morphy-Richards, Ltd., Morphy, D. W., and Russell, W. M.—Crumb-trays or under-trays for electric toasters and like appliances. 7th December, 1949. (649530.)

31642. Morphy-Richards, Ltd., Morphy, D. W., and Russell, W. M.—Electric toasters. 7th December, 1949. (649531.)

32260. Crabtree & Co., Ltd., J. A., and Morgan, R. W.—Electric lampholders of the bayonet type. 29th September, 1949. (649812.)

33467. Ekco-Ensign Electric, Ltd., and Stickley, W. A.—Electric transformers. 30th December, 1949. (649816.)

1949

18500. Standard Telephones & Cables, Ltd., and Dunkley, R. A. G.—Electric frequency modulating systems. 13th July, 1949. (649820.)

20117. Akt.-Ges. für Technische Studien.—Thermal power plants. 2nd August, 1949. (649539.)

27583. Pye, Ltd., and Lawson, D. I.—Direction-finding equipment. 1st March, 1948. (Divided out of 649701.) (649760.)

29599. Wayman, S. C.—Oil pressure operated electric switch for motor vehicles and internal-combustion engines. 18th November, 1949. (649540.)

Earth Boring Machines

A RANGE of earth boring machines introduced by the Magnetic Equipment Co., Cosham, Portsmouth, offers drilling capacities comparable to the largest American machines. These "Mageo" machines have capacities up to 21–24in diameter with depths of 6–8ft, the holes being drilled vertically or at an angle as required, with the machine operating on ground at any angle.

"Mageo" earth boring machine for drilling 18in by 6ft holes

Simplicity of operation has been borne in mind and all controls are operated from one station; feed in and lifting are by hydraulic power to obtain the fastest drilling speeds. As an example 18in holes can be drilled in heavy wet clay at 2¼ft per minute.

Machines can be provided in various forms complete with 40–50 h.p. engine for mounting as a unit on a lorry, as a self-contained machine, self-propelled or for towing. The problem of drilling pole holes from a road while reaching over a hedge has been overcome by a modified form of machine.

In many cases conditions are such that a tractor is the most adaptable form of power unit.

The hole is perfectly round and vertical, a feature unobtainable with a simple swinging link mechanism. Heavy duty units of this type are available for most types of tractors as well as "Land Rovers."

The provision of hydraulic lift gear on a tractor is not required, although the pump can be used if fitted. The hydraulic feed in and out so essential for fast drilling in hard ground is part of the auger operating gear.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our Official Notices" section, the date of the issue is given in parentheses.

Baldock.—8th January. U.D.C. Street lighting units (sodium and tungsten) on trunk road A.1. Surveyor, Council Offices, Baldock, Herts.

Belfast.—2nd February. City Council. Fire-lighting equipment for 33 kV substation switchgear. (See this issue.)

Carlisle.—26th January. City Council. Electrical installation at the Belah Junior and Infants' School. (See this issue.)

Durham.—County Education Committee. Installation of electricity in 20 schools in various parts of the county. County architect, Court Lane, Durham.

Felling (Durham).—U.D.C. Seventy-six 2 kW fires to be installed on the Ellen Wilkinson housing estate. T. M. Baker, clerk to the Council, Council Buildings.

London.—STEPNEY.—15th January. Borough Council. Fluorescent lighting at Whitechapel Public Library. (See this issue.)

Morpeth.—Town Council. Installation of electricity in 175 houses at present supplied only with gas. Borough engineer, Bridge Street.

Sutton and Cheam.—13th January. Borough Council. Supply and erection of automatic electric sewage pumping plant (three pumps), with motors, starter panels, etc., for Epsom Road pumping station. N. H. Michell, borough surveyor, High Street, Sutton, Surrey.

ORDERS PLACED

Carlisle.—City Council. Installation of electricity in forty-two houses.—North Western Electricity Board.

Durham.—County Education Committee. Electrical installations in schools, etc.:—Annfield Plain (£398).—T. Mitchelson (Electrical), Ltd. East Hetton (£2,804).—Doves (Darlington), Ltd. Lynesack (£187).—R. V. Hogg & Co. West Cornforth (£120).—F. E. White (Coxhoe).

Hull.—Corporation Welfare Services Committee. Installation of electric light and power at "Mentone House," Hessle (£796).—City engineer.

Middlesbrough.—Education Committee. Installation of electric light and power at Newport Road Infants' School (£339).—Doves, Ltd., Darlington. Similar work at Newport Road Junior School (£375).—C. Horne & Co., Ltd., Middlesbrough.

South Shields.—Education Committee. Electrical work for the new Simonside County Infants' School (£1,631).—Law and Burns.

Stockton-on-Tees.—Town Council. Electrical installations in shops and flats on the Albany and Ragworth estates (£378).—Haigh & Ringrose, Ltd., Middlesbrough.

Swindon.—Corporation. Accepted (subject to the approval of the Ministry of Health). External lighting on the Lydiard Park estate (£375).—Ferris Bros.

Thornaby-on-Tees.—Town Council. Electrical installations in 40 houses on the Thornaby Road estate (£907).—J. Bushell & Sons.

Whitley Bay.—U.D.C. Electrical installations in houses at the Foxhunters site (£1,166).—Norie Electric Construction Co., Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldershot.—Flats (72), Denmark Street; borough engineer.

Bingham (Notts).—Houses (14) for R.D.C.; Frost & Leatherland, Ltd., Dame Agnes Street, Nottingham.

Birkenhead.—New police headquarters; Cartwright Bros. (Little Sutton), Ltd., Little Sutton.

Birmingham.—Sisters' home at Dudley Road Hospital (£135,719) for Regional Hospital Board; Maddocks & Walford, Ltd., builders, Tyburn Road, Birmingham, 24.

Bootle.—Houses for B.C.: Lloyd & Cross, Ltd., 68, Argyle Street, Birkenhead (110 houses); S. Byron (Formby), Ltd. (16).

Bradford.—Garage for 70 vehicles, Hammerton Street depot; city architect.

Extensions to Textile Department of Technical College; city architect.

Brierley Hill.—Three-storey municipal offices, High Street, for U.D.C.; J. R. Moore, architect, Council Offices.

Brighton.—Seven shops and flats, Lower Bevendean (£23,583); Rice & Son, Ltd.

Houses (12), Parkside estate; T. J. Braybon & Son, Ltd., Brighton.

Burnley.—Police headquarters; Bradshaw, Gass and Hope, architects, 19, Silverwell Street, Bolton.

Cannock.—Bungalows (28), Broomhill, for U.D.C.; B. Jones, 100, Market Street, Hednesford.

Cardiff.—Offices, Birch Grove, for Government Departments; Gee, Walker & Slater, Ltd., builders, Coychurch Road, Bridgend.

Carlisle.—Extensions to newspaper offices, for *Cumberland News*; J. H. Martindale & Son, architects, Cathedral Chambers, Castle Street.

Additions to science laboratories at Carlisle Grammar School; borough engineer.

Chatham.—Shops and offices, 195/203, High Street; Peter Temple, architect, 24, Bryanston Square, W.1.

Chelmsford.—Rebuilding Y.M.C.A. premises, Victoria Road; A. E. Wiseman, architect, 10, Duke Street.

Cleethorpes.—Old people's hostel between Thurnscoe Lane and Taylor's Avenue (£35,000) for Lindsey C.C.; A. R. Clark, county architect, Newland, Lincoln.

Darlington.—Secondary grammar school for girls, Hummersknott estate; borough architect, Central Buildings, Darlington.

Derbyshire.—Schools programme for 1951: Alfreton County Junior (£59,880), Ashbourne Secondary (£44,000, Phase 1), Buxton Fairfield Primary (£41,120), Eckington Birch Hill Infants (£38,000), Heanor Marlpool Infants (£45,160), Ripley Infants (£31,320), Ripley Junior (£37,800) and Staveley Inkersall Primary (£12,000, Phase II); F. Hamer Crossley, county architect, Derby.

Dudley.—Houses (220), Sledmere estate, south western section; G. F. Webb, architect, High Street.

Glamorgan.—County primary schools at Fairfield Road, Penarth and Cimla, Neath; L. R. Gower, county architect, Glamorgan County Hall, Cardiff.

Grantham.—Hostel block and other works, Kesteven Training College, Stoke Rochford Hall; L. D. Tomlinson, architect, Quadrant Arcade, Romford, Essex.

Haverfordwest.—Houses (116), Mount Airey and Jury Lane; borough engineer.

Hebburn-on-Tyne.—Houses (80), Victoria Road East, and sixty in Mill Lane; R. C. Bestow, U.D.C. surveyor.

Lancashire.—Additional classrooms at Fleetwood Grammar School (£14,025); county architect, Lancaster.

Liverpool.—Flats and houses, Smithdown Lane, Grey Street, Marsh Street, Northcote Street and Horrockes Avenue; city architect.

Newcastle-under-Lyme.—Houses (207) and 36 flats, Roe Lane; C. B. Parkes, architect, Bournville Estate Office, Birmingham.

Rochdale.—Dwellings (207), Kirkholt estate; W. H. G. Mercer, borough surveyor, Town Hall.

Rowley Regis (Staffs).—Houses (76), Cox's Farm estate, Tividale; borough surveyor, Municipal Buildings, Old Hill, Cradley Heath.

Saltburn.—Houses (36), Irvin Avenue; W. R. Ellis, U.D.C. surveyor.

Scarborough.—Rebuilding factory in Melrose Street for E. T. W. Dennis & Sons, Ltd.; Baker and Clark, architects, York Place, Scarborough.

Sedgley.—Showrooms and offices; Staffordshire & Worcestershire Glazed Tile Co., Himley Road, Lower Gornal.

Sheffield.—Factory, Carlisle Street; Perko, Ltd., 66, St. Mary's Road.

Skegness.—Houses (38), St. Clement's estate, for U.D.C.; I. M. Cule, clerk, Town Hall.

Southampton.—Rebuilding premises, High Street; Shepherd & Hedger, furnishers.

Staines.—Matthew Arnold Secondary School (£109,800) for Middlesex E.C.; W. S. Try, Ltd., High Street, Cowley, Uxbridge.

Stockport.—New school at Vale Road, Reddish; Roy and Partners, 25, Cross Street, Manchester.

Stoke-on-Trent.—Houses (18), Blurton Farm estate; Brammer & Co., Ltd.

Stretford.—Police headquarters, Talbot Road; county architect, Preston.

Upholland.—Houses (12), Mill Lane; T. Dickenson & Son, 280, Ormskirk Road.

Warsop.—Houses (36), Sookholme estate; Adam Eastwood & Sons, Burns Lane.

Watford.—Block of shops and flats (£75,000), St. Albans Road and High Street; Watford Ideal Homes, Ltd., Faircross House, High Street.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within a month of 20th December.

ACCUMULATEUR FULMEN (design). No. 686,653. Class 9. Electric accumulators, parts and fittings, all included in Class 9.—Société de l'Accumulateur Fulmen, Clichy (Seine), France. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

ROADMASTER. No. 692,099. Class 9. Ammeters and testing apparatus for electric battery cells.—Excelsior Motor Co., Ltd., Excelsior Works, King's Road, Tyseley, Birmingham, 11.

DISTRAN. No. 692,358. Class 9. Radio transmitting and receiving apparatus, radio apparatus for use in navigation and surveying, radar apparatus and instruments, and electrical apparatus and instruments included in Class 9.—Decca Record Co., Ltd., 1 & 3, Brixton Road, London, S.W.9.

CAVALCADE. No. 692,521. Class 9. Television apparatus and instruments.—C. S. Gray, 25, Astons Road, Moor Park, Herts.

HIVAC. No. 685,454. Class 11. Electric lamps.—Hivac, Ltd., Greenhill Crescent, Harrow-on-the-Hill, Middx.

HAMILAIR. No. 691,224. Class 11. Electrical heating and ventilating apparatus.—Hale, Hamilton & Co., Ltd., 107, Old Broad Street, London, E.C.2.

SANTALITE. No. B691,998. Class 11. Electric lamps and sets of wired electric lamps for decoration.—J. N. Somers, Ltd., Acton Market, Crown Street, Acton, London, W.3.

CADET. No. 692,279. Class 11. Cooking apparatus and parts, all included in Class 11.—Simplex Electric Co., Ltd., Broadwell Road, Oldbury, near Birmingham.